HYDROLOGY DATA FOR LAKES AND CATCHMENTS IN MUSKOKA/HALIBURTON (1980 -1992)

APRIL 1994

Ontario

Ministry of
Environment
and Energy

ISBN 0-7778-2535-X

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PIBS 3017

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1. INTRODUCTION

The Dorset Research Centre has been studying small catchments in the Muskoka/Haliburton region of south central Ontario since 1976. A major component of these studies is the development of mass balance models to predict the impact of atmospheric deposition on catchments in this area. Quantitative hydrological information is required to construct catchment and lake water balances, and as input to the chemical mass balance models. An earlier data report (Scheider et al. 1983b) presented data from the first four years of the study (1976 - 1980). This report presents basic hydrologic data from study watersheds for the period 1980 to 1992.

1.1 Description of the Study Area

Eight catchments have been sampled routinely since 1980 for water chemistry and hydrologic components (Locke and Scott 1986, Girard and Reid 1990). The monitoring of these catchments currently include twenty sub-catchments, two tributaries, and the eight outflows. In addition, hydrological and chemical flux information were measured on four additional streams (Twelve Mile South, Twelve Mile North, Beech Inflow One and Paint Inflow One), chosen to further broaden the range of catchment types investigated. Meteorological data were collected at five stations from 1980 to 1984 (Reid and Dillon 1993). In 1984, the number of meteorological data collection stations was reduced to four (Locke and deGrosbois 1986).

Two sub-catchments, Harp 4 and Plastic 1 (HP4 and PC1), are studied on a more intensive level with many tributaries sampled throughout the sub-catchment. In addition, the hydrology of two tributaries, PC1-08 and HP4-21, has been measured since 1985 and 1987, respectively. The locations of all catchments and meteorologic sampling sites are shown in Figure 1. Drainage basin areas for each catchment and sub-catchment are listed in Table 1. Detailed information on lake morphometry is found in Girard and Reid (1990) and sub-catchment physiography is described in Scheider et al. (1983b) and Girard et al. (1985).

Blue Chalk (BC), Red Chalk (RC) and Crosson (CN) lakes drain via the Black River into Lake Simcoe and ultimately into Georgian Bay via the Severn River. Harp (HP) Lake drains via the North Muskoka River into Lake Muskoka and then to Georgian Bay via the Moon River. The drainage of Dickie (DE), Heney (HY), Paint (PT) and Chub (CB) Lakes is also into Georgian Bay via the South Muskoka River, Lake Muskoka and the Moon River. Plastic (PC), Twelve Mile (TW) and Beech (BE) Lakes drain into Lake Ontario at the Bay of Quinte via the Gull River, the Kawartha Lakes system and the Trent River.

A description of the bedrock and surficial geology underlying the study catchments is described in Jeffries and Snyder (1983) and Girard et al. (1985). Detailed geological information on the Harp 4 and Plastic 1 (HP4 and PC1) watersheds is described in Kirkwood and Nesbitt (1991) and Law (1991). Forest cover is typical northern hardwood mixed forest, consisting of hard maple, beech, yellow birch, hemlock, spruce and balsam fir. More detailed information is described in Lozano and Porton (1986). Significant beaver activity and the subsequent flooding has had a continuous influence on the hydrology and chemistry of stream catchments. Detailed information is available in Devito and Dillon (1993) and Dahm et al. (1987). Urban development within sub-catchments has been limited, however, development around the shorelines of our lake basins has increased significantly over the past 20 years. More detailed information is described in Lakeshore Capacity Study Trophic Status Report (1986).

1.2 Methods

The methods used in the collection of hydrological data are summarized in Locke and Scott (1986). The type and period of operation of hydrological structures used on study catchments are summarized in Table 2. Analysis of the hydrologic data, including estimation of mean daily flow for each of the sub-catchments and calculation of catchment water balances, is documented in Scott et al. (1994). The collection of meteorologic data used in the catchment water balance calculations is described in Locke and deGrosbois (1986) and Hutchinson et al. (1993).

Units and Abbreviations

In order to facilitate the use of this report, the following conventions define some basic hydrologic terms relevant for data herein.

Watershed	The outer boundry around a catchment. It is the point of elevation where flows divide. All points inside the boundry flow into the catchment, while no points outside the watershed flow into the catchment. The watershed extends around the line of break in flow, and the gauging structure on the outflow stream of the catchment.
Catchment	Describes the total area within a watershed boundary.
Sub-catchment	Describes the area drained by a single stream.
Stage (m)	The height of water measured above an established level at a gauging structure.
Discharge	The volume of water that passes a particular reference section in a unit of time.
Stage-discharge relationships	The relationship between the measured stage (height) or water level and the discharge of water from a stream at that point.
Lake Level	The gauge height reading corresponding to the lake level.
Mean Daily Discharge	An estimate of the mean daily flow from a sub-catchment through a calibrated gauging structure.

Perennial Stream Describes a stream with a minimum mean daily discharge >0 during the period 1980-1992. (Table 3 shows 6 of 34 study streams are classified as perennial.)

Intermittent Stream Describes a stream that is dry for periods of every year during the period 1980-1992. The periodicity of flow for all study catchments (intermittent and perennial as defined by Ward (1967) and described in Scheider et al. (1983a), are summarized in Table 9 for the twelve years of the study.

Residence Time The length of time required to displace a volume of water equivalent to the lake volume. We calculate this term as lake volume/total loss of water from the lake.

Flushing Time Flushing time or replenishment rate is calculated as lake volume/lake outfall and is longer than residence time because the water loss to evaporation is not included.

1.3 Hydrometeorologic Network

Gauging of streams within the Muskoka/Haliburton study area began in 1976. These sub-catchments were numerically identified from 1-n with a lake specific alphabetic abbreviation included (e.g., HP3 = "HP" Harp Lake Catchment, "#3" sub-catchment). In only one circumstance is an outflow (Blue Chalk) considered an inlet to an adjacent catchment (Red Chalk). Numeric numbers followed by an alphabetic code of A are not tributaries of adjacent sub-catchments. They represent additional sub-watershed delineations adjacent to previously defined sub-catchment areas (e.g., HP3 and HP3A). Refer to Section 1.2 for a description of watershed terms.

In representative catchments throughout the study area, stations were established for the collection of meterological parameters. From 1976 to 1984, fourteen stations were used; each station included a standard rain gauge and bulk precipitation collector (Locke and de Grosbois, 1986). Currently four stations are used to monitor precipitation throughout the study area. These stations are numerically identified 1-n with a lake specific alphabetic abbreviation and type (e.g., HPP2 = HP Harp Lake, P Precipitation, 2 site number). The main station (also known as PT1P) was established in 1977 and was moved short distances (<1000 m) in 1978 and 1982 to its present location near to the Dorset Research Centre. This station has included a variety of different types of sensors and was maintained initially by the Canadian Centre for Inland Waters (CCIW) from 1976-1987. The Atmospheric Environment Service (AES) has also maintained a network of stations throughout the area. Table 4 gives the location and full description of all stations included in the hydrometeorologic network.

Table 5 provides a summary of some of the meteorologic parameters measured by these sites that strongly influence the hydrology in small headwater catchments.

2. Runoff (Stage-Discharge Graphs and Equations)

Runoff, as defined in Scheider et al. (1983b) with respect to the water balance equation for a lake, is water draining the terrestrial portion of a lake's catchment or drainage from upstream lakes. Operationally, it includes channelized stream flow measured at hydrological gauging stations. The type and period of use of each gauging station in the study area is summarized in Table 7. Stage-discharge relationships for each sub-catchment are plotted in Figure 2. Four of these study sites have more than one relationship (DE8, DEØ, RC3, RCØ) as a result of modifications in structure type. Preliminary stage-discharge relationships were developed for all sites between 1980 and 1984. Further refinements were made with the inclusion of 1985-1990 data. Components of these stage-discharge relationships are shown in Figure 3. Detailed discussions on methods of determining correctness of fit is given in Scott et al. (1994). The preliminary relationships were used to predict mean daily

discharge for the period 1980-1984 while latter relationships were used to describe 1984-1992 mean daily discharge. Detailed methods of determining missing mean daily discharges were also described in Scott et al. (1994). The minimum, maximum and mean values of mean daily discharge for each stream and each year are summarized in Table 6. Total annual discharge ($10^3\ m^3\ yr^{-1}$) is summarized in Table 7.

Expressing annual discharge as areal runoff (total annual discharge [$m^3\ yr^{-1}$]/basin area [m^2]) factors out basin area and facilitates between basin comparison of annual discharge. Values of annual areal runoff ($m\ yr^{-1}$) are summarized in Table 8. Minimum and maximum annual areal runoff from 1980-1992 are summarized in Table 9. The 1980-1992 mean value of all sites was 0.519 $m\ yr^{-1}$, comparing well with the reported long term mean value of 0.4-0.5 $m\ yr^{-1}$ for the area (Anon. 1978).

Expressing unit runoff as yield (annual runoff [$m\ yr^{-1}$]/annual precipitation depth [$m\ yr^{-1}$]) further standardizes the annual discharge data. Yield is the fraction of the annual precipitation which is lost from the basin as streamflow. Values of annual yield are summarized in Table 10. Annual 1980-1992 minimum and maximum yields by station are summarized in Table 11. The mean yield for the 1980-1992 period was 0.511 with mean values for the 32 individual watersheds ranging from 0.389 to 0.589.

Peak runoff occurs in March, April and May in response to snowmelt. Secondary peaks occur in October, November and December in response to increased precipitation and less interception by the terrestrial component. Residual runoff occurs in June, July and August due to terrestrial uptake and again in January and February as precipitation is stored as accumulated snow. The percentage of annual flow that occurs in peak runoff periods ranged from 30.7% to 82% with a mean value of 56.5%. The percentage of annual flow occurring in secondary runoff periods ranged from 3% to 43.4% with a mean value of 23.5%. Annual values of per cent seasonal distribution are described in Table 12.

3. Annual Water Balances

The lake catchment water balance is an expression of the principle of conservation of mass. It assumes that the sum of water inputs to a catchment are equal to the sum of the outputs.

The model used for the period 1980 to 1992 is essentially the same as used by Scheider et al. (1983b). The model is described by:

$$\sum I_G + \sum I_U + P_{LA} + G_I = E + O \pm \Delta L + G_O \tag{1}$$

The inputs terms are: the sum of inflows from the gauged area of the watershed (ΣI_G), the sum of inputs from the ungauged areas (ΣI_U), the precipitation falling on the lake surface (P_{LA}) and the groundwater seepage into the catchment (G_I). The loss terms are: the outflow (O), the change in lake storage or volume (Δ L), loss from the lake by evaporation (E) and groundwater loss from the lake catchment (G_O). Note that the change in lake level is entered as a loss, but can be either positive or negative, depending upon whether water is added or removed over the time period for which the balance is performed. It is assumed that the total volume of ground water passing through catchments from lakes on the Canadian Shield is negligible.

Equation 1 can be rearranged to provide an estimate of the accuracy of the measured water balance for a catchment. This balance term is expressed as a percentage $\leq$10%.

$$B = \frac{(O + E + \Delta L + G_O) - (\Sigma I_G + \Sigma I_U + P_{LA} + G_I)}{O + E + \Delta L + G_O} \times 100\% \tag{2}$$

The methods used to measure the components of the water balance have been described in Scheider et al. (1983b) and more recently in Hutchinson et al. (1993).

In computing these balances, each supply and loss term was measured or estimated individually and calculated on an annual basis, and described in detail in Sections 3.1 and 3.2. Water balances for all study catchments are described in Section 3.3.

Supply:

P_{LA} An estimated component expressed as direct contribution to the lake surface. The term is defined as lake area (m^2) x mean annual precipitation depth (m).

ΣI_G A measured component expressed as m^3. Further definitions and application of this term may be found in Scott et al. (1994).

ΣI_U An estimated component expressed as unmeasured terrestrial runoff. The term is defined as the sum of the measured inflows (m^3)/sum of their watershed areas (m^2) x the ungauged component (m^2).

G_I Groundwater is considered to be an unimportant component of the lake water balance. This is due to the impervious nature of the bedrock and the paucity of the surficial deposits in most of our study watersheds (Jeffries and Snyder 1983).

Loss:

O A measured component expressed as m^3. Further definition and application of this term may be found in Scott et al. (1994).

E An estimated component further defined in Scheider et al. (1983b) and Scott et al. (1994), expressed as direct loss from the lake surface. The term is defined as lake area (m^2) x estimated evaporation rate (m).

ΔL A measured component based on the hydrologic year further defined in Scheider et al. (1983b) and Scott et al. (1994). The term is defined as lake area (m^2) x measured loss (m).

G_o As described in the supply side of this section, groundwater loss is considered to be unimportant.

The balance term is expressed as the net sum of the errors of the individual loss term divided by the supply term.

3.1 Supply Terms

Precipitation

Daily precipitation depth was calculated at each station and used to estimate a Muskoka/Haliburton monthly precipitation depth (Figure 4). Table 13 summarizes the monthly and annual precipitation depths for 1980-1992. More detailed information on these calculations is available in Reid and Dillon (1994) and Hutchinson and Snell (1993a,b). Annual amounts ($m^3 yr^{-1}$) of precipitation falling on the lake surface is an input to the water balance and calculated as lake area (m^2) x annual depth of precipitation (m). Annual precipitation depths (shown in Figure 4) ranged from 0.896 m yr^{-1} (1989-1990) to 1.230 m yr^{-1} (1981-1982), with a mean of 1.010 m yr^{-1} (1980-1992). The average depth of precipitation (for the 4 main stations, PTIP, HYP2, HPP2 and PCP2) per event was 24.48 mm with the Heney Lake site (HYP2) showing the highest average and largest maximum amount of 25.42 and 144.8 mm. The wettest month (1980-1992) was usually October, with the greatest single precipitation event also falling in October. February generally had the least amount of precipitation, though there were some exceptional years (1985, 1988).

The largest 20 storm events recorded at the 4 main stations are given in Table 14. These four main stations have been used throughout the period 1980-1992 to derive the

precipitation component of the hydrologic water balance for all study catchments (other stations were also included at various times during the period 1980 to 1984, but have not been included in this summary). Sites within the same geographic area often illustrate the sporadic nature of precipitation. Summary event periods include seven consecutive days with at least one major event ≥30 mm. These storms ranged from 64.2 to 119.5 mm total rainfall and were distributed throughout the summer and fall periods.

Mean Daily Discharge

Values of mean daily discharge (L/sec) have been computed for each study stream. Graphs showing daily discharge for all inlet sub-catchments over nine hydrologic years are presented in Figure 6. Table 7 summarizes annual discharges for 1980-1992. More detailed information on these calculations is available in Scott et al. (1994). Annual discharge (m^3 yr^{-1}) of surface runoff is an input to the water balance and calculated as basin size (m^2) x surface runoff (m).

Unmeasured Terrestrial Runoff

It is assumed that the annual contributions from the ungauged sub-catchments will respond to atmospheric inputs similarly to that of the gauged sub-catchments within the same drainage basin. Therefore, the method described to calculate this component (supply term ΣI_U) is assumed to be roughly correct.

The percent catchment area unmeasured ranged from 13% at Crosson to 100% at Heney. In a situation where a significant percentage of the catchment is ungauged (Heney and Blue Chalk), proximate catchments with similar catchment characteristics were used. The percentage of annual flow that occurs as unmeasured terrestrial runoff is summarized in Table 17.

Groundwater

Groundwater was previously described in Scheider et al. (1983b) as a component of unlikely importance. Further studies of groundwater and its significance in the water balance have shown that unless deep till is present, this component is negligible.

3.2 Loss Terms

Mean Daily Discharge from Outlets

The hydrograph plots of mean daily discharge for study lake outlets are presented in Figure 7. The percentage of real versus estimated data is shown for each graph. Estimation procedures are described in Scott et al. 1994..

Lake Evaporation

The principal terms of the energy balance model in use for the study period (June 1, 1980 - May 31, 1987 were previously described in Scheider et al. (1983b). Subsequently,a climatological based model (Morton 1979) was employed to estimate evaporation for the study period June 1, 1987 - May 31, 1992.

Annual of lake evaporation (m yr^{-1}) are summarized in Table 15. Mean annual values ranged from 0.570 m yr^{-1} in 1980-1982 to 0.727 m yr^{-1} in 1991-1992. The 1980-1992 mean value was 0.648 m yr^{-1}, comparing well with Scheider et al. (1983b) figure of 0.660 m yr^{-1} and the long term estimate of 0.70 m yr^{-1} (Hydrologic Atlas of Canada 1978).

Lake evaporation for each study lake is plotted in Figure 8. From 1980 to June 1987, evaporation was computed for periods between lake sampling dates (lake heat budgets were input to the model). After 1987, regional weather data was used to derive a monthly

estimate of lake evaporation. Peak values (usually > 100 m month^{-1}) were most commonly observed in July for all lakes.

Lake Levels (Storage)

No measurements were made of ground water storage in the terrestrial component of the catchment. Lake level gauges were in place for the 1980-1992 study period, excluding Crosson and Heney, in which level gauges were installed in 1982. Level gauges are referenced to a bench mark each year which is not related to area geodetic survey. Shift deviations in gauge elevation are referenced to the original data and weekly readings are adjusted accordingly. The bottom of the staff gauge is given an arbitrary value of 1.0 m which ensures positive readings should the lake level recede below the gauge. The components of the measurement of lake level are shown in Figure 9. Measurements are taken on each site visit and are used to detect change in lake storage rather than absolute elevation. Estimated data for Crosson and Heney (1980-1982) were obtained by multiple regression fit to other lake gauges visited on the same day. Changes in lake level are plotted in Figure 10 and summarized on an annual basis in Table 16. Annual lake level changes were generally small, ranging from -0.315 m to 0.322 m. Over the 12 years of this study period, mean changes in lake levels ranged from -0.043 m to 0.380 in the 8 study lakes. Artificial control of lake levels does not occur on any of our study lakes.

3.3 Water Balance Tables

The terms of the water balance model used by the Dorset Research Centre were described at the beginning of Section 3. The balance term is expressed as the net sum of the errors of the individual loss term/supply term. All annual budgets balanced to within 10% excluding Heney in 1988-1989 (+10.9%) and Blue Chalk 1991-1992 (+10.2%); the mean balance was +1.987 on the eight study lakes over the 12 study years.

There was no consistent pattern excluding Blue Chalk in the error term of the balance. Blue Chalk was positive in all 12 years of the study, while other lakes showed a random occurrence of positive and negative errors. A positive error indicates that either the loss was too great or the supply too small.

Terrestrial runoff supplies most of the water (excluding Blue Chalk - 50%) to the lake, ranging from 62% at Plastic to 83% at Crosson. Precipitation directly to the lake surface correspondingly ranged from 38% to 17% while it contributed 50% to Blue Chalk. Loss via outflow was the most significant export in all lakes ranging from 70% on Blue Chalk to 89% on Red Chalk and Crosson. Evaporation values ranged correspondingly from 10% to 31%.

Individual supply and loss terms for each study catchment are presented in Table 17.

4. Residence and Flushing Time for Study Lakes

Flushing time is calculated as lake volume/lake outflow and is longer than residence time because the water loss to evaporation is not included. Annual values ranged from 1.58 years at Heney Lake to 5.89 years at Blue Chalk Lake.

Residence time is calculated as lake volume/total loss of water from the lake. Annual values ranged from 1.19 years at Heney Lake to 4.02 years at Blue Chalk Lake.

Residence and flushing times for the eight study lakes are plotted in Figure 11 and summarized in Table 18. Definitions of these terms are given in the Units and Abbreviations in Section 1.2 of this report.

5. Acknowledgements

Many people contributed to the execution of this study. Wesley Kerr, Central Ontario Water Survey and Andrew Laycock, Canag, were the primary contractors for network operation. Ed de Grosbois and Dave Gardner provided necessary computer and program support. Thanks also to Renee Morrison for her patience throughout the preparation of this report. The field personnel are too numerous to mention, but we thank them for their contribution, and Peter Dillon for his editorial comments.

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Table 1 Watershed area of gauged and ungauged inlets, lake areas, total watershed areas and % watershed gauged for 8 study lakes. Units are shown in $10^4 m^2$ (equivalent to 1 hectare) so that the derivation of water balances also given in Table 17 can be clearly shown.

Lake	Station	Area Gauged Inlets (10^4m^2)	Area Ungauged Inlets (10^4m^2)	Lake Area (10^4m^2)	Total Area (10^4m^2)	% Watershed Gauged* (10^4m^2)	% Sub-catchment ungauged** (10^4m^2)
Blue Chalk	BC0			523500.00	1582800.00	46.0	81.0
	BC1	204300.00	855000.00				
	BE1	5716000.00					
Chub	CB0			344100.00	3062500.00	71.9	32.0
	CB1	596900.00	861500.00				
	CB2	1260000.00					
Crosson	CN0			567400.00	5784900.00	88.7	13.0
	CN1	4562700.00	654800.00				
Dickie	DE0			936000.00	5000200.00	73.5	33.0
	DE5	299800.00					
	DE6	218000.00					
	DE8	669600.00					
	DE10	788900.00					
	DE11	762700.00	1325200.00				
Harp	HP0			713800.00	5420400.00	83.4	19.0
	HP3	260000.00					
	HP3A	196500.00					
	HP4	1190900.00					
	HP4_21	41200.00					
	HP5	1905300.00					
	HP6	99700.00					
	HP6A	152800.00	901400.00				
	HY0		716600.00	213700.00	930300.00	23.0	100.0
Plastic	PC0			321400.00	1276400.00	43.5	76.0
	PC1	233400.00	721600.00				
	PC1_08	34500.00					
Paint	PT1	213000.00					
Red Chalk	RC0			571300.00	5894900.00	66.3	18.0
	RC1	1335800.00					
	RC2	269600.00					
	RC3	704900.00					
	RC4	454600.00	975900.00				
	RCE			130500.00			
	RCM			440800.00			
	TWN	4267000.00					
	TWS	1718000.00					

* Includes gauged inlets and lake surface area.
** Includes % unmeasured terrestrial input of total terrestrial input.

Table 2 Type and period of operation of hydrological structures used on gauged watersheds.

Watershed	Period of Operation		Hydrological Gauging Structure
BC0	16-Oct-80	present	Parshall flume with low flow structure
BC1	19-Nov 80	present	90 degree V-notch weir
BE1	15-Dec-80	present	Parshall flume with low flow structure
CB0	01-May-76	30-Sep-80	120 degree V-notch weir
	12-Nov-80	present	Parshall flume with low flow structure
CB1	01-Jun-76	31-Aug-80	90 degree V-notch weir
	18-Nov-80	present	90 degree V-notch weir
CB2	16-Aug-77	30-Sep-80	Cippoletti weir with low flow structure
	15-Sep-81	present	Parshall flume with low flow structure
CN0	11-Dec-80	present	Parshall flume with low flow structure
CN1	31-Aug-81	present	Parshall flume with low flow structure
DE0	28-Aug-79	11-Sep-90	H flume with 90 degree V-notch
	24-Sep-90	present	Parshall flume with low flow structure
DE5	10-Sep-81	present	Parshall flume with low flow structure
DE6	14-Aug-79	present	90 degree V-notch weir
DE8	14-Aug-79	19-Aug-81	H flume with 90 degree V-notch
	25-Aug-81	present	Parshall flume with low flow structure
DE10	14-Aug-79	present	90 degree V-notch weir and rectangular weir
DE11	05-Oct-79	present	120 degree V-notch weir
HP0	24-Feb-81	present	Parshall flume with low flow structure
HP3	12-Sep-79	present	90 degree V-notch weir
HP3A	26-Sep-79	present	90 degree V-notch weir and rectangular weir
HP4	03-Jun-81	present	Parshall flume with low flow structure
HP4_21	13-Oct-87	present	90 degree V-notch weir
HP5	15-Aug-79	present	Parshall flume with low flow structure
HP6	01-Sep-76	31-Oct-80	90 degree V-notch weir
	03-Jun-81	present	90 degree V-notch weir
HP6A	03-Jun-81	present	90 degree V-notch weir
HY0	03-Sep-81	present	Parshall flume with low flow structure
PC0	04-Oct-79	present	Parshall flume with low flow structure
PC1	04-Oct-79	present	90 degree V-notch weir and rectangular weir
PC1_08	22-Oct-85	present	90 degree V-notch weir
PT1	01-Jun-76	31-Aug-81	90 degree V-notch weir
	21-Sep-81	present	90 degree V-notch weir
RC0	05-Dec-79	24-Oct-83	Parshall flume with low flow structure
	30-Nov-83	present	Parshall flume with low flow structure
RC1	18-Sep-80	present	Parshall flume with low flow structure
RC2	27-Nov-80	present	90 degree V-notch weir
RC3	16-Jun-78	31-Oct-80	120 degree V-notch weir
	22-Sep-81	26-Aug-91	Parshall flume with low flow structure
	30-Oct-91	present	Parshall flume with low flow structure
RC4	01-Jun-76	31-Oct-80	120 degree V-notch weir
	22-Sep-81	present	Parshall flume with low flow structure
TWN	01-Jul-76	31-Oct-80	H flume
	24-Nov-80	present	Parshall flume with low flow structure
TWS	26-Jan-81	present	120 degree V-notch weir and rectangular weir

Table 3 Stream flow duration patterns for the 34 gauged watersheds, 1980-1992.

Watershed	Intermittent Streams	Perennial	Perennial/Intermittent
BC0			x
BC1			x
BE1		x	
CB0			x
CB1			x
CB2			x
CN0		x	
CN1			x
DE0			x
DE5			x
DE6			x
DE8			x
DE10			x
DE11			x
HP0			x
HP3		x	
HP3A			x
HP4			x
HP4_21			x
HP5			x
HP6			x
HP6A			x
HY0			x
PC0			x
PC1			x
PC1_08			x
PT1			x
RC0			x
RC1			x
RC2	x		
RC3		x	
RC4		x	
TWN		x	
TWS			x

Table 4. Hydrometeorologic Station Identification

STN	LATITUDE	LONGITUDE	STATION DESCRIPTION
HYDROLOGIC STATONS:			
BC0	4511.43	7856.18	Blue Chalk Outflow
BC1	4512.07	7855.49	Blue Chalk Infow 1
CB0	4512.38	7859.05	Chub Outflow
CB1	4512.42	7859.35	Chub 1
CB2	4512.56	7859.00	Chub 2
CN0	4505.12	7901.59	Crosson Outflow
CN1	4504.58	7902.29	Crosson Infow 1
DE0	4508.34	7905.41	Dickie Outflow
DE05	4508.41	7905.22	Dickie Inflow 5
DE06	4508.46	7905.13	Dickie Inflow 6
DE08	4509.09	7905.26	Dickie Inflow 8
DE10	4509.18	7904.51	Dickie Inflow 10
DE11	4508.51	7904.45	Dickie Inflow 11
HP0	4522.50	7908.05	Harp Outflow
HP3	4522.28	7908.26	Harp Inflow 3
HP3A	4522.29	7908.33	Harp Inflow 3a
HP4	4522.49	7908.28	Harp Inflow 4
HP4-21	4522.44	7908.35	Harp Inflow 4 - sub-catchment 21
HP5	4522.60	7907.55	Harp Inflow 5
HP6	4522.40	7907.37	Harp Inflow 6
HP6A	4522.46	7907.42	Harp Inflow 6a
HY0	4507.42	7905.54	Heney Outflow
PC0	4510.32	7848.51	Plastic Outflow
PC1	4510.41	7849.37	Plastic Inflow 1
PC1-08	4510.54	7849.45	Plastic Inflow 1 - sub-catchment 08
PT1	4513.53	7856.13	Paint Inflow 1
RC0	4511.11	7856.46	Red Chalk Outflow
RC1	4511.37	7856.25	Red Chalk Inflow 1
RC2	4511.26	7856.25	Red Chalk Inflow 2
RC3	4511.28	7857.20	Red Chalk Inflow 3
RC4	4511.31	7857.18	Red Chalk Inflow 4
TWN	4501.49	7841.14	Twelve Mile North
TWS	4501.42	7841.09	Twelve Mile South
METEOROLOGIC STATIONS:			
DOR2	4513.00	7856.00	Dorset (DRC) Meteorologic Station
DWI	4523.00	7854.00	Dwight Meteorologic Station
HAL	4501.00	7833.00	Haliburton Airport
HPP2	4523.00	7907.00	Harp Lake Meteorologic Station
HUN	4520.00	7913.00	Huntsville WPTC Meteorologic Station
HYP2	4508.00	7906.00	Heney Lake Meteorologic Station
MUS	4458.00	7918.00	Muskoka Airport
PCP2	4511.00	7850.00	Plastic Lake Meteorologic Station
PT1P	4513.00	7856.00	Paint Lake (DRC) Meteorologic Station

Table 5 Summary of meteorologic data for the Muskoka-Haliburton area.

Meteorologic Parameter	Summary Value	Period Record	Stations Included in Summary
Mean Annual Precip.	1.01 m	June 80 - May 92	PT1P, HYP2, HPP2, PCP2, HYP, HPP, PCP
Mean Annual Snowfall	3.9 m	June 76 - May 89	DOR2, HUN, MUS, DWI, HAL
	2.8 m	June 80 - May 89	DOR2, HUN, MUS, DWI, HAL
Mean Snow Event Depth	0.13 m	1976 - 1989	DOR2, HUN, MUS
Maximum Snow Depth	0.92 m	1976 - 1989	DOR2, HUN, MUS
Mean Jan. Temp.	-11.9 °C	1976 - 1989	DOR2, HUN, MUS, PT1P, HYP2, HPP2, PCP2
	-11.2 °C	1980 - 1989	DOR2, HUN, MUS, PT1P, HYP2, HPP2, PCP2
Mean July Temp.	19.0 °C	1976 - 1989	DOR2, HUN, MUS, PT1P, HYP2, HPP2, PCP2
	19.1 °C	1980 - 1989	DOR2, HUN, MUS, PT1P, HYP2, HPP2, PCP2
Mean Annual Global Radiation	12,681 Kj/m^2	1980 - 1991	PT1P, DOR2
Mean Annual Lake Evaporation	0.65 m/yr	1980 - 1992	BC, CB, CN, DE, HY, PC, RC
Mean Ice-On Date	Dec. 2	1976 - 1992	BC, CB, CN, DE, HY, PC, RC
Mean Ice-Off Date	April 21	1976 - 1992	BC, CB, CN, DE, HY, PC, RC
Mean Frost-free days	121.3	1984 - 1991	HPP2, HYP2, PCP2
		1978 - 1991	PT1P
Mean Annual Runoff	0.52 m/yr	1980 - 1992	32 study streams

*See Table 4 for station abbreviation descriptions.

Table 6 Minimum, maximum and mean values of mean daily discharge (L/sec) for 34 gauged watersheds, 1980-1992.

Watershed	Minimum Discharge (L/sec)			Maximum Discharge (L/sec)			Mean Discharge (L/sec)		
	1980-81	1981-82	1982-83	1980-81	1981-82	1982-83	1980-81	1981-82	1982-83
BC0	4.270	0.000	0.000	130.000	182.000	194.000	30.770	23.215	34.604
BC1	0.008	0.000	0.000	54.000	71.200	45.300	2.872	2.324	3.976
BE1	9.010	0.349	1.390	837.000	1220.000	1390.000	125.442	84.675	134.503
CB0	7.180	0.120	0.322	318.000	441.000	338.000	56.179	39.961	62.206
CB1	0.110	0.002	0.006	119.000	177.000	127.000	9.238	7.781	10.343
CB2	0.868	0.070	0.000	272.000	348.000	352.000	25.060	18.218	25.275
CN0	32.100	12.100	11.100	1050.000	1050.000	782.000	125.230	89.352	136.277
CN1	2.470	0.586	0.945	1250.000	1160.000	826.000	93.812	66.909	103.474
DE0	16.500	0.000	0.030	970.000	952.000	562.000	112.136	77.685	109.467
DE5	0.110	0.000	0.027	84.400	70.400	49.800	7.393	4.327	6.799
DE6	0.495	0.000	0.019	62.200	56.900	48.700	5.254	3.651	5.149
DE8	0.029	0.000	0.000	209.000	274.000	139.000	16.119	12.633	16.548
DE10	1.110	0.000	0.000	201.000	235.000	220.000	16.828	12.963	18.164
DE11	0.972	0.003	0.000	249.000	196.000	194.000	15.554	12.359	16.903
HP0	3.730	0.000	-0.000	561.000	958.000	720.000	104.701	94.860	111.831
HP3	0.268	0.000	0.000	70.600	114.000	70.900	6.020	5.600	5.997
HP3A	0.278	0.087	0.066	91.200	89.200	52.700	4.482	4.020	4.266
HP4	1.700	1.130	0.750	192.000	304.400	153.000	24.903	21.078	22.622
HP4_21									
HP5	1.110	0.293	0.077	414.000	765.000	493.000	42.622	40.515	44.607
HP6	0.012	0.000	0.000	20.100	44.100	23.900	2.222	2.214	2.254
HP6A	0.009	0.000	0.000	71.300	61.100	45.000	3.141	2.477	3.080
HY0	1.210	0.000	0.000	135.000	122.000	80.100	20.842	13.254	19.478
PC0	0.869	0.544	1.990	195.000	210.000	411.000	19.913	18.002	28.832
PC1	0.084	0.000	0.000	79.000	70.100	71.300	4.709	3.541	5.967
PC1-08									
PT1	0.054	0.000	0.000	42.900	77.900	52.100	3.951	2.950	4.104
RC0	28.000	0.271	0.454	699.000	935.000	710.000	117.952	94.704	137.861
RC1	1.030	0.724	0.000	357.000	338.500	428.000	24.665	17.520	30.394
RC2	0.000	0.000	0.000	63.400	70.800	73.100	5.143	3.918	6.263
RC3	1.330	1.050	1.010	156.000	160.000	167.000	15.220	11.027	15.591
RC4	0.670	0.260	0.610	60.800	96.400	98.000	7.796	6.682	10.102
TWN	10.600	3.080	1.910	673.000	925.000	889.000	85.978	64.843	100.893
TWS	2.880	0.583	0.932	281.000	418.000	384.000	35.073	25.640	38.792

Table 6 (continued ...)

Watershed	Minimum Discharge (L/sec) 1983-84	1984-85	1985-86	Maximum Discharge (L/sec) 1983-84	1984-85	1985-86	Mean Discharge (L/sec) 1983-84	1984-85	1985-86
BC0	0.000	0.000	0.624	274.000	197.000	146.000	21.420	31.513	24.232
BC1	0.000	0.000	0.000	38.200	80.300	58.500	2.833	3.137	2.766
BE1	0.393	1.970	1.960	677.000	1040.000	846.000	69.437	104.402	79.706
CB0	0.000	0.023	1.160	249.000	611.000	431.000	44.915	58.337	44.277
CB1	0.000	0.000	0.027	85.600	166.000	129.000	7.419	9.078	6.876
CB2	0.000	0.000	0.009	151.000	376.000	247.000	18.231	24.677	18.790
CN0	2.770	4.960	8.855	592.000	1240.000	1060.000	91.865	133.703	96.442
CN1	0.258	1.090	1.060	549.000	1110.000	919.000	81.030	101.966	80.076
DE0	0.000	0.000	0.742	451.000	972.000	676.000	79.007	102.433	79.022
DE5	0.000	0.000	0.013	51.000	89.800	99.600	5.177	6.234	5.117
DE6	0.000	0.000	0.000	34.000	73.200	35.600	3.956	4.661	3.334
DE8	0.000	0.000	0.023	88.500	191.000	164.000	11.849	13.489	11.193
DE10	0.000	0.000	0.000	138.000	227.000	280.000	12.489	14.917	11.964
DE11	0.000	0.000	0.000	105.000	253.000	180.000	11.437	15.051	11.861
HP0	0.000	0.006	0.071	497.000	1170.000	1020.000	81.251	117.569	114.983
HP3	0.000	0.028	0.110	43.400	90.600	93.530	4.623	5.847	5.907
HP3A	0.000	0.038	0.086	59.900	73.000	134.000	3.324	4.277	4.503
HP4	0.762	1.140	1.360	145.000	341.000	268.000	17.801	24.446	24.749
HP4_21									
HP5	0.000	0.392	1.270	288.000	840.720	654.000	31.764	46.641	43.303
HP6	0.000	0.000	0.001	15.600	40.000	36.000	1.698	2.217	2.380
HP6A	0.000	0.000	0.000	26.200	41.400	52.500	2.123	2.905	2.785
HY0	0.000	0.000	0.018	55.100	152.000	71.700	14.058	19.944	15.332
PC0	1.620	0.680	0.985	129.000	302.000	169.000	19.199	24.178	19.491
PC1	0.000	0.000	0.012	38.000	82.800	56.400	4.120	4.688	3.717
PC1_08									
PT1	0.000	0.000	0.000	65.500	58.400	54.600	3.635	4.210	3.056
RC0	0.000	0.119	14.400	471.000	976.000	731.000	94.088	115.497	93.655
RC1	0.000	0.121	0.071	253.000	398.000	408.000	19.680	25.569	20.396
RC2	0.000	0.000	0.000	40.300	69.900	49.600	4.476	5.104	4.171
RC3	0.251	0.872	2.530	106.000	259.000	249.000	11.015	15.530	12.822
RC4	0.186	0.580	0.699	65.900	149.000	120.000	7.346	9.508	7.627
TWN	0.869	3.040	2.450	387.000	1046.730	585.000	54.819	94.057	64.318
TWS	0.034	0.000	0.000	187.000	291.000	287.000	22.624	31.432	24.772

Table 6 (continued ...)

Watershed	Minimum Discharge (L/sec) 1986-87	1987-88	1988-89	Maximum Discharge (L/sec) 1986-87	1987-88	1988-89	Mean Discharge (L/sec) 1986-87	1987-88	1988-89
BC0	1.280	0.000	0.000	103.000	193.000	112.000	22.405	20.690	21.343
BC1	0.000	0.000	0.000	37.500	73.100	61.400	2.050	2.111	2.233
BE1	5.230	1.660	1.100	693.000	1160.000	668.000	80.748	76.149	70.625
CB0	2.030	0.000	0.000	235.000	411.000	247.000	37.371	41.475	40.213
CB1	0.078	0.000	0.000	94.600	143.000	128.000	5.382	6.526	6.301
CB2	0.144	0.000	0.000	204.000	328.000	245.000	15.213	19.846	17.082
CN0	19.900	2.180	3.480	725.000	1240.000	477.000	86.932	81.151	91.192
CN1	0.000	0.000	0.000	768.380	1200.000	460.000	64.498	68.356	73.617
DE0	0.874	0.000	0.000	416.000	893.886	354.000	58.997	63.831	60.502
DE5	0.012	0.000	0.000	61.700	76.700	43.500	3.811	3.806	4.207
DE6	0.035	0.000	0.000	54.600	68.700	29.100	2.927	3.261	3.243
DE8	0.236	0.000	0.000	111.000	204.000	78.400	8.385	9.779	9.624
DE10	0.176	0.000	0.000	164.000	281.000	82.300	10.267	11.453	10.901
DE11	0.000	0.000	0.000	156.000	229.000	88.200	9.167	10.989	10.534
HP0	0.013	0.000	0.000	714.000	904.000	565.000	76.353	76.816	79.191
HP3	0.116	0.000	0.000	57.300	80.900	49.900	3.669	4.162	4.228
HP3A	0.092	0.020	0.014	51.000	59.100	95.000	2.590	3.061	3.281
HP4	1.090	0.270	0.234	219.000	247.000	235.000	15.554	16.863	17.258
HP4_21			0.185			6.490			1.300
HP5	1.020	0.000	0.033	430.000	651.000	922.000	27.752	31.602	32.159
HP6	0.000	0.000	0.000	24.100	30.400	29.000	1.503	1.494	1.643
HP6A	0.000	0.000	0.000	39.400	32.350	42.400	1.787	1.735	2.056
HY0	0.095	0.000	0.000	99.700	100.000	66.000	11.766	12.726	14.000
PC0	3.490	0.000	0.607	117.000	164.000	102.000	19.987	16.036	17.623
PC1	0.030	0.000	0.000	52.300	69.100	33.700	3.410	3.308	3.671
PC1_8	0.020	0.000	0.000	8.690	14.400	12.200	0.489	0.515	0.535
PT1	0.000	0.000	0.000	27.800	60.400	75.080	2.392	3.014	2.977
RC0	31.200	0.000	0.000	478.000	865.000	483.000	84.381	80.694	86.828
RC1	0.792	0.000	0.000	261.000	486.000	376.000	18.151	18.526	20.088
RC2	0.000	0.000	0.000	49.700	68.000	39.300	3.615	3.823	4.119
RC3	3.320	0.262	0.134	92.500	219.000	95.000	11.910	11.389	12.328
RC4	0.744	0.216	0.000	73.000	136.000	172.000	6.483	6.956	6.924
TWN	1.920	0.968	0.770	512.000	507.000	396.000	60.844	51.525	55.658
TWS	0.396	0.079	0.023	211.000	405.000	190.000	23.032	21.501	21.751

Table 6 (continued ...)

Watershed	Minimum Discharge (L/sec) 1989-90	1990-91	1991-92	Maximum Discharge (L/sec) 1989-90	1990-91	1991-92	Mean Discharge (L/sec) 1989-90	1990-91	1991-92
BC0	0.000	0.000	0.000	106.000	184.000	129.000	22.095	26.031	19.795
BC1	0.000	0.000	0.000	52.200	62.993	36.138	2.048	2.553	1.926
BE1	1.190	1.600	1.270	588.000	1400.000	736.000	75.384	99.011	68.837
CB0	0.000	0.000	0.000	270.000	352.000	407.000	39.428	46.470	38.436
CB1	0.000	0.000	0.000	93.600	150.000	138.000	6.600	8.510	6.492
CB2	0.000	0.000	0.000	189.628	461.653	318.566	16.614	20.990	15.738
CN0	1.930	2.400	2.510	528.000	1670.000	901.000	91.933	106.087	78.317
CN1	0.000	0.000	0.000	767.000	1645.002	851.000	75.835	83.350	61.079
DE0	0.000	0.000	0.000	424.623	487.440	706.473	58.064	90.344	76.417
DE5	0.000	0.000	0.000	67.200	142.992	72.900	4.771	5.882	4.442
DE6	0.000	0.000	0.000	27.000	96.300	62.900	3.230	4.725	3.669
DE8	0.000	0.000	0.000	111.000	185.000	156.000	9.871	11.698	9.352
DE10	0.000	0.000	0.000	128.000	251.000	216.000	10.822	14.611	12.060
DE11	0.000	0.000	0.000	94.200	318.000	180.000	11.272	14.248	10.346
HP0	0.000	0.000	0.000	612.000	784.000	856.000	72.860	94.796	74.200
HP3	0.000	0.000	0.000	60.500	78.600	74.200	3.672	4.691	3.710
HP3A	0.008	0.004	0.011	79.600	138.000	46.300	2.762	3.701	2.839
HP4	0.178	0.343	0.419	173.000	285.000	284.000	15.850	20.022	16.719
HP4_21	0.000	0.055	0.047	3.560	8.505	8.880	0.472	0.671	0.533
HP5	0.041	0.090	0.005	427.000	560.971	649.000	27.735	35.854	29.055
HP6	0.000	0.000	0.000	28.600	35.500	33.500	1.391	1.743	1.418
HP6A	0.000	0.000	0.000	27.700	59.000	36.700	1.672	2.351	1.849
HY0	0.000	0.000	0.000	59.600	99.800	74.100	10.545	14.814	11.550
PC0	0.000	0.000	2.050	76.600	586.000	132.000	18.375	21.075	17.362
PC1	0.000	0.000	0.000	62.940	104.000	71.800	3.843	4.346	3.129
PC1_8	0.000	0.000	0.000	10.800	25.300	11.500	0.559	0.689	0.481
PT1	0.000	0.000	0.000	56.600	45.600	44.800	2.835	3.280	2.687
RC0	0.000	0.000	0.000	506.000	851.000	694.000	85.898	102.927	82.744
RC1	0.000	0.000	0.000	341.000	432.000	366.000	18.879	22.506	18.781
RC2	0.000	0.000	0.000	64.100	80.200	67.643	3.958	4.644	3.732
RC3	0.151	0.129	0.261	129.000	184.000	220.000	11.322	13.405	11.903
RC4	0.151	0.124	0.246	104.000	153.000	88.600	7.094	8.307	6.564
TWN	1.280	0.855	0.739	330.000	754.000	527.000	54.474	73.302	51.942
TWS	0.000	0.000	0.000	177.000	216.410	270.000	22.498	27.546	19.831

Table 7 Total annual discharge ($10^3 m^3 yr^{-1}$) for the 34 gauged watersheds, 1980-1992.

Watershed	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92
BC0	970.368	732.096	1091.261	677.356	993.806	764.191	706.570	654.278	673.065	696.791	820.913	625.973
BC1	90.587	73.294	125.389	89.577	98.918	87.226	64.649	66.759	70.410	64.597	80.504	60.918
BE1	3955.925	2670.319	4241.685	2195.756	3292.416	2513.594	2546.459	2408.024	2227.226	2377.316	3122.409	2176.798
CB0	1771.663	1260.224	1961.740	1420.328	1839.712	1396.316	1178.519	1311.550	1268.173	1243.403	1465.478	1215.429
CB1	291.332	245.387	326.187	234.604	286.299	216.841	169.723	206.357	198.703	208.132	268.385	205.279
CB2	790.298	574.529	797.060	576.523	778.213	592.574	479.751	627.584	538.693	523.925	661.929	497.662
CN0	3949.258	2817.806	4297.631	2905.005	4216.455	3041.407	2741.478	2566.186	2875.847	2899.196	3345.567	2476.572
CN1	2958.447	2110.030	3263.155	2562.365	3215.614	2525.267	2034.022	2161.583	2321.577	2391.540	2628.526	1931.452
DE0	3536.309	2449.877	3452.152	2498.376	3230.334	2492.034	1860.529	2018.476	1907.996	1831.111	2849.076	2416.475
DE5	233.149	136.443	214.420	163.710	196.607	161.381	120.185	120.350	132.667	150.452	185.481	140.467
DE6	165.694	115.130	162.389	125.114	146.999	105.156	92.305	103.115	102.285	101.873	149.023	116.032
DE8	508.337	398.381	521.849	374.694	425.377	352.990	264.432	309.224	303.488	311.302	368.917	295.721
DE10	530.695	408.809	572.832	394.929	470.408	377.281	323.787	362.176	343.782	341.296	460.771	381.360
DE11	490.523	389.765	533.065	361.665	474.660	374.045	289.104	347.501	332.214	355.472	449.318	327.162
HP0	3301.850	2991.501	3526.718	2569.344	3707.645	3626.109	2407.865	2429.105	2497.358	2297.697	2989.486	2346.378
HP3	189.857	176.603	189.107	146.183	184.376	186.279	115.717	131.614	133.338	115.810	147.928	117.335
HP3A	141.341	126.783	134.541	105.111	134.885	142.002	81.667	96.787	103.463	87.090	116.726	89.790
HP4	785.327	664.718	713.393	562.926	770.945	780.482	490.496	533.251	544.247	499.852	631.429	528.683
HP4_21									8.035	14.890	21.160	16.867
HP5	1344.118	1277.690	1406.724	1004.455	1470.855	1365.590	875.190	999.341	1014.154	874.650	1130.676	918.796
HP6	70.084	69.825	71.080	53.680	69.919	75.056	47.402	47.239	51.814	43.851	54.953	44.844
HP6A	99.066	78.129	97.119	67.144	91.615	87.831	56.366	54.861	64.851	52.730	74.150	58.462
HY0	657.262	417.982	614.245	444.562	628.939	483.513	371.068	402.437	441.490	332.545	467.186	365.245
PC0	627.979	567.715	909.254	607.121	762.478	614.684	630.310	507.108	555.755	579.473	664.618	549.016
PC1	148.511	111.671	188.176	130.300	147.844	117.204	107.533	104.613	115.784	121.179	137.052	98.933
PC1_08								16.300	16.865	17.621	21.739	15.210
PT1	124.606	93.020	129.427	114.938	132.771	96.364	75.436	95.310	93.893	89.404	103.426	84.975
RC0	3719.736	2986.574	4347.577	2975.279	3642.301	2953.508	2661.051	2551.726	2738.222	2708.878	3245.912	2616.575
RC1	777.832	552.508	958.494	622.321	806.338	643.195	572.398	585.844	633.509	595.372	709.764	593.906
RC2	162.197	123.573	197.522	141.545	160.957	131.530	114.011	120.891	129.893	124.806	146.449	117.999
RC3	479.990	347.739	491.677	348.323	489.757	404.361	375.602	360.146	388.773	357.054	422.729	376.403
RC4	245.840	210.713	318.578	232.298	299.830	240.527	204.451	219.965	218.354	223.709	261.967	207.570
TWN	2711.396	2044.900	3181.754	1733.502	2966.185	2028.323	1918.781	1629.354	1755.223	1717.889	2311.648	1642.539
TWS	1106.063	808.583	1223.331	715.419	991.225	781.223	726.323	679.899	685.935	709.493	868.685	627.089

Table 8. Annual areal runoff ($m\ yr^{-1}$) for the 34 gauged watersheds, 1980-1992.

Watershed	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	Mean 1980-92
BC0	0.613	0.463	0.689	0.428	0.628	0.483	0.446	0.413	0.425	0.440	0.519	0.395	0.495
BC1	0.443	0.359	0.614	0.438	0.484	0.427	0.316	0.327	0.345	0.316	0.394	0.298	0.397
BE1	0.692	0.467	0.742	0.384	0.576	0.440	0.445	0.421	0.390	0.416	0.546	0.381	0.492
CB0	0.579	0.412	0.641	0.464	0.601	0.456	0.385	0.428	0.414	0.406	0.479	0.397	0.472
CB1	0.488	0.411	0.546	0.393	0.480	0.363	0.284	0.346	0.333	0.349	0.450	0.344	0.399
CB2	0.627	0.456	0.633	0.458	0.618	0.470	0.381	0.498	0.428	0.416	0.525	0.395	0.492
CN0	0.683	0.487	0.743	0.502	0.729	0.526	0.474	0.444	0.497	0.501	0.578	0.428	0.549
CN1	0.648	0.462	0.715	0.562	0.705	0.553	0.446	0.474	0.509	0.524	0.576	0.423	0.550
DE0	0.707	0.490	0.690	0.500	0.646	0.498	0.372	0.404	0.382	0.366	0.570	0.483	0.509
DE5	0.778	0.455	0.715	0.546	0.656	0.538	0.401	0.401	0.443	0.502	0.619	0.469	0.544
DE6	0.760	0.528	0.745	0.574	0.674	0.482	0.423	0.473	0.469	0.467	0.684	0.532	0.568
DE8	0.759	0.595	0.779	0.560	0.635	0.527	0.395	0.462	0.453	0.465	0.551	0.442	0.552
DE10	0.673	0.518	0.726	0.501	0.596	0.478	0.410	0.459	0.436	0.433	0.584	0.483	0.525
DE11	0.643	0.511	0.699	0.474	0.622	0.490	0.379	0.456	0.436	0.466	0.589	0.429	0.516
HP0	0.609	0.552	0.651	0.474	0.684	0.669	0.444	0.448	0.461	0.424	0.552	0.433	0.533
HP3	0.730	0.679	0.727	0.562	0.709	0.716	0.445	0.506	0.513	0.445	0.569	0.451	0.588
HP3A	0.719	0.645	0.685	0.535	0.686	0.723	0.416	0.493	0.527	0.443	0.594	0.457	0.577
HP4	0.659	0.558	0.599	0.473	0.647	0.655	0.412	0.448	0.457	0.420	0.530	0.444	0.525
HP4_21									0.195	0.361	0.514	0.409	0.370
HP5	0.705	0.671	0.738	0.527	0.772	0.717	0.459	0.525	0.532	0.459	0.593	0.482	0.598
HP6	0.703	0.700	0.713	0.538	0.701	0.753	0.475	0.474	0.520	0.440	0.551	0.450	0.585
HP6A	0.648	0.511	0.636	0.439	0.600	0.575	0.369	0.359	0.424	0.345	0.485	0.383	0.481
HY0	0.707	0.449	0.660	0.478	0.676	0.520	0.399	0.433	0.475	0.357	0.502	0.393	0.504
PC0	0.492	0.445	0.712	0.476	0.597	0.482	0.494	0.397	0.435	0.454	0.521	0.430	0.495
PC1	0.636	0.478	0.806	0.558	0.633	0.502	0.461	0.448	0.496	0.519	0.587	0.424	0.546
PC1_08								0.473	0.489	0.511	0.630	0.441	0.509
PT1	0.585	0.437	0.608	0.540	0.623	0.452	0.354	0.447	0.441	0.420	0.486	0.399	0.483
RC0	0.631	0.507	0.738	0.505	0.618	0.501	0.451	0.433	0.465	0.460	0.551	0.444	0.525
RC1	0.582	0.414	0.718	0.466	0.604	0.482	0.429	0.439	0.474	0.446	0.531	0.445	0.502
RC2	0.602	0.458	0.733	0.525	0.597	0.488	0.423	0.448	0.482	0.463	0.543	0.438	0.517
RC3	0.681	0.493	0.698	0.494	0.695	0.574	0.533	0.511	0.552	0.507	0.600	0.534	0.572
RC4	0.541	0.464	0.701	0.511	0.660	0.529	0.450	0.484	0.480	0.492	0.576	0.457	0.529
TWN	0.635	0.479	0.746	0.406	0.695	0.475	0.450	0.382	0.411	0.403	0.542	0.385	0.501
TWS	0.644	0.471	0.712	0.416	0.577	0.455	0.423	0.396	0.399	0.413	0.506	0.365	0.481
Mean	0.644	0.501	0.696	0.491	0.638	0.531	0.420	0.441	0.447	0.437	0.548	0.428	0.519
n	32	32	32	32	32	32	32	33	34	34	34	34	34

Table 9 Minimum and maximum annual unit runoff (m yr^{-1}) for the 34 gauged watersheds, 1980-1992.

Watershed	Year	Minimum (m yr^{-1})	Year	Maximum (m yr^{-1})
BC0	1991-92	0.395	1982-1983	0.689
BC1	"	0.298	"	0.614
BE1	"	0.381	"	0.742
CB0	1986-87	0.385	"	0.641
CB1	"	0.284	"	0.546
CB2	"	0.381	"	0.633
CN0	1991-92	0.428	"	0.743
CN1	"	0.423	"	0.715
DE0	1989-90	0.366	1980-81	0.707
DE5	1986-87 & 1987-88	0.401	"	0.778
DE6	1986-87	0.423	"	0.760
DE8	"	0.395	"	0.759
DE10	"	0.410	1982-83	0.726
DE11	"	0.379	"	0.699
HP0	1989-90	0.424	1984-85	0.684
HP3	1986-87 & 1989-90	0.445	1980-81	0.730
HP3A	1986-87	0.416	1985-86	0.723
HP4	1986-87	0.412	1980-81	0.659
HP4_21	1988-89	0.195	1990-91	0.514
HP5	1986-87 & 1989-90	0.459	1984-85	0.772
HP6	1989-90	0.440	1985-86	0.753
HP6A	"	0.345	1980-81	0.648
HY0	1991-92	0.393	"	0.707
PC0	1987-88	0.397	1982-83	0.712
PC1	1991-92	0.424	"	0.806
PC1_08	"	0.441	1990-91	0.630
PT1	1986-87	0.354	1982-83	0.608
RC0	1987-88	0.433	"	0.738
RC1	1981-82	0.414	"	0.718
RC2	1986-87	0.423	"	0.733
RC3	1981-82	0.493	1984-85	0.695
RC4	1986-87	0.450	1982-83	0.701
TWN	1987-88	0.382	"	0.746
TWS	1990-91	0.365	"	0.712

Table 10 Annual yield for the 34 gauged watersheds, 1980-1992.

Watershed	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	Mean 1980-92
BC0	0.572	0.457	0.560	0.431	0.586	0.454	0.461	0.441	0.442	0.491	0.510	0.440	0.487
BC1	0.414	0.354	0.499	0.442	0.452	0.402	0.327	0.348	0.358	0.353	0.387	0.332	0.389
BE1	0.646	0.461	0.603	0.387	0.537	0.414	0.460	0.449	0.405	0.464	0.537	0.424	0.482
CB0	0.540	0.406	0.521	0.467	0.560	0.429	0.398	0.457	0.431	0.453	0.471	0.441	0.464
CB1	0.455	0.406	0.444	0.396	0.447	0.342	0.294	0.369	0.346	0.389	0.442	0.383	0.393
CB2	0.585	0.450	0.514	0.461	0.576	0.443	0.394	0.531	0.445	0.464	0.517	0.439	0.485
CN0	0.637	0.481	0.604	0.506	0.680	0.495	0.490	0.473	0.517	0.560	0.569	0.476	0.541
CN1	0.605	0.457	0.581	0.566	0.657	0.521	0.461	0.505	0.529	0.585	0.567	0.471	0.542
DE0	0.660	0.484	0.561	0.503	0.602	0.469	0.385	0.430	0.397	0.409	0.560	0.538	0.500
DE5	0.726	0.450	0.581	0.550	0.612	0.507	0.414	0.428	0.460	0.560	0.608	0.521	0.535
DE6	0.709	0.522	0.605	0.578	0.629	0.454	0.438	0.504	0.488	0.522	0.672	0.592	0.559
DE8	0.708	0.588	0.633	0.564	0.592	0.496	0.408	0.492	0.471	0.519	0.542	0.491	0.542
DE10	0.628	0.512	0.590	0.504	0.556	0.450	0.424	0.489	0.453	0.483	0.574	0.538	0.517
DE11	0.600	0.505	0.568	0.478	0.580	0.462	0.392	0.486	0.453	0.520	0.579	0.477	0.508
HP0	0.568	0.545	0.529	0.477	0.638	0.630	0.459	0.478	0.479	0.473	0.542	0.481	0.525
HP3	0.681	0.671	0.591	0.566	0.661	0.674	0.460	0.540	0.533	0.497	0.559	0.502	0.578
HP3A	0.671	0.637	0.557	0.539	0.640	0.680	0.430	0.525	0.548	0.495	0.584	0.508	0.568
HP4	0.615	0.551	0.487	0.476	0.604	0.617	0.426	0.477	0.475	0.469	0.521	0.494	0.518
HP4_21									0.203	0.375	0.505	0.455	0.385
HP5	0.658	0.662	0.600	0.531	0.720	0.675	0.475	0.559	0.554	0.513	0.584	0.536	0.589
HP6	0.656	0.692	0.579	0.542	0.654	0.709	0.491	0.505	0.541	0.491	0.542	0.500	0.575
HP6A	0.605	0.505	0.517	0.443	0.559	0.541	0.381	0.383	0.441	0.385	0.477	0.426	0.472
HY0	0.659	0.444	0.537	0.481	0.630	0.489	0.412	0.461	0.494	0.399	0.494	0.437	0.495
PC0	0.459	0.439	0.579	0.479	0.557	0.453	0.510	0.424	0.453	0.507	0.512	0.478	0.488
PC1	0.594	0.473	0.655	0.562	0.591	0.473	0.476	0.478	0.516	0.580	0.577	0.471	0.537
PC1_08								0.504	0.508	0.571	0.620	0.491	0.539
PT1	0.546	0.431	0.494	0.543	0.581	0.426	0.366	0.477	0.458	0.469	0.477	0.444	0.476
RC0	0.589	0.500	0.599	0.508	0.576	0.472	0.467	0.462	0.483	0.513	0.541	0.494	0.517
RC1	0.543	0.409	0.583	0.469	0.563	0.453	0.443	0.468	0.493	0.498	0.523	0.495	0.495
RC2	0.561	0.453	0.595	0.529	0.557	0.459	0.437	0.478	0.501	0.517	0.534	0.487	0.509
RC3	0.635	0.487	0.567	0.498	0.648	0.540	0.551	0.545	0.574	0.566	0.590	0.594	0.566
RC4	0.505	0.458	0.570	0.515	0.615	0.498	0.465	0.516	0.500	0.549	0.567	0.508	0.522
TWN	0.593	0.473	0.606	0.409	0.648	0.447	0.465	0.407	0.428	0.449	0.533	0.428	0.491
TWS	0.601	0.465	0.579	0.419	0.538	0.428	0.437	0.422	0.415	0.461	0.497	0.406	0.472
Mean	0.600	0.495	0.565	0.494	0.595	0.500	0.434	0.470	0.466	0.487	0.539	0.497	0.508
n	32	32	32	32	32	32	32	33	34	34	34	34	34

Table 11 Minimum and maximum annual yield for the 34 gauged watersheds, 1980-1992.

Watershed	Year	Minimun m yr $^{-1}$	Year	Maximum m yr $^{-1}$
BC0	1983-84	0.431	1980-81	0.572
BC1	1986-87	0.327	1982-83	0.499
BE1	1983-84	0.387	1980-81	0.646
CB0	1986-87	0.398	1984-85	0.560
CB1	*	0.294	1980-81	0.455
CB2	*	0.394	*	0.585
CN0	1987-88	0.473	1984-85	0.680
CN1	1981-82	0.457	*	0.657
DE0	1986-87	0.385	1980-81	0.660
DE5	*	0.414	*	0.726
DE6	*	0.438	*	0.709
DE8	*	0.408	*	0.708
DE10	*	0.424	*	0.628
DE11	*	0.392	*	0.600
HP0	1989-90	0.473	1984-85	0.638
HP3	1986-87	0.460	1980-81	0.681
HP3A	*	0.430	*	0.681
HP4	*	0.426	1985-86	0.617
HP4_21	1988-89	0.203	1990-91	0.505
HP5	*	0.475	1984-85	0.720
HP6	*	0.491	1985-86	0.709
HP6A	*	0.381	1980-81	0.605
HY0	1989-90	0.399	*	0.659
PC0	1987-88	0.424	1982-83	0.579
PC1	1991-92	0.471	1980-81	0.594
PC1_08	*	0.491	1989-90	0.571
PT1	1986-87	0.366	*	0.546
RC0	1987-88	0.462	1982-83	0.599
RC1	1981-82	0.409	*	0.583
RC2	1986-87	0.437	*	0.595
RC3	1981-82	0.487	1984-85	0.648
RC4	*	0.458	1990-91	0.567
TWN	1983-84	0.409	1984-85	0.648
TWS	1991-92	0.406	1980-81	0.601

Table 12 Seasonal distribution of runoff from each stream basin as a % for the 32 gauged watersheds, 1980-1992.

STN	Peak Runoff (Mar-May) Max	Mean	Min	Secondary Runoff (Oct-Dec) Max	Mean	Min	Residual Runoff (Jun-Sep & Jan-Feb) Max	Mean	Min
BC0	64.2	50.1	33.3	30.0	19.8	7.5	39.7	30.2	20.9
BC1	82.0	64.1	41.3	36.0	22.0	8.6	32.1	13.9	4.9
BE1	74.7	56.8	34.6	34.0	21.1	10.1	41.5	22.1	10.5
CB0	68.1	58.3	39.8	30.9	21.3	12.4	32.0	20.5	12.3
CB1	74.8	61.6	41.2	34.6	22.4	12.3	33.2	15.9	6.6
CB2	75.5	59.9	37.5	34.1	22.8	12.9	38.8	17.2	6.8
CN0	62.7	51.1	36.3	33.3	20.9	12.1	37.7	28.0	21.3
CN1	63.5	52.4	36.5	38.1	27.4	18.2	35.1	20.2	12.2
DE0	68.8	55.3	40.1	33.2	22.8	11.2	33.5	21.9	13.6
DE5	77.5	60.7	40.6	33.8	22.8	14.5	38.0	16.5	4.0
DE6	74.3	59.0	35.4	35.4	24.0	13.9	40.6	17.0	5.8
DE8	72.0	57.7	32.9	33.4	24.0	14.0	42.0	18.3	8.4
DE10	73.4	59.7	38.8	34.6	23.3	12.3	35.6	17.0	7.8
DE11	77.5	62.2	41.9	34.7	22.3	12.4	34.6	15.6	5.7
HP0	68.3	51.9	36.0	39.4	26.0	8.5	33.2	22.1	11.8
HP3	73.9	56.0	34.6	36.6	24.6	8.2	41.2	19.4	7.4
HP3A	78.0	58.1	30.7	36.5	23.5	4.5	45.6	18.4	6.2
HP4	71.8	55.2	38.2	34.7	23.8	8.0	38.5	21.0	9.5
HP4_21									
HP5	77.6	59.3	38.1	37.7	23.0	6.8	34.3	17.7	6.3
HP6	75.1	56.5	39.0	35.2	24.9	8.4	38.2	18.6	7.6
HP6A	77.9	59.7	37.9	38.8	23.3	3.0	39.6	17.0	5.1
HY0	64.3	54.4	35.2	33.8	24.4	12.4	37.5	21.2	10.6
PC0	60.9	49.6	33.5	38.9	23.3	10.0	36.9	27.1	22.3
PC1	68.6	56.8	41.0	40.6	27.3	16.4	33.1	15.8	5.1
PC1_08									
PT1	64.1	53.9	33.2	37.3	27.8	18.6	40.3	18.3	7.6
RC0	65.9	52.7	37.7	32.2	21.5	10.4	34.9	25.8	16.6
RC1	71.3	56.7	36.5	43.4	26.2	14.7	36.8	17.1	6.8
RC2	67.4	56.7	41.4	40.1	27.7	19.9	34.6	15.7	5.1
RC3	71.0	55.7	38.9	34.7	21.5	12.5	36.6	22.8	11.5
RC4	66.8	54.7	41.5	36.7	24.6	16.9	31.7	20.8	11.6
TWN	66.1	56.2	37.6	32.2	21.9	12.7	39.2	21.9	10.8
TWS	73.5	58.1	35.8	34.4	21.1	12.4	37.5	20.8	9.2
n = 32									
Max	82.0	64.1	41.9	43.4	27.8	19.9	45.6	30.2	22.3
Mean	70.9	56.5	37.4	35.5	23.5	11.7	36.9	19.8	9.7
Min	60.9	49.6	30.7	30.0	19.9	3.0	31.7	13.9	4.0
Without Outflows n = 24									
Max	82.0	64.1	41.9	43.4	27.8	19.9	45.6	30.2	12.2
Mean	72.9	55.3	37.7	36.1	23.9	12.2	37.5	18.3	7.6
Min	63.5	52.4	30.7	32.2	21.1	3.0	31.7	13.9	4.0
Outflow n = 8									
Max	68.3	58.3	33.3	39.4	26.0	12.4	37.5	28.0	22.3
Mean	65.4	52.9	36.5	34.0	22.5	10.6	35.7	24.6	16.2
Min	60.9	49.6	40.1	30.0	19.8	7.5	32.0	20.5	10.6

Table 13 Monthly and annual summaries of precipitation depth (mm) in the Muskoka/Haliburton area.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Hy Yr	Mean
1980						127.18	151.79	99.11	103.26	119.58	73.56	80.72	80/81	1071.7
1981	49.57	78.13	54.59	70.72	63.47	99.12	41.12	144.59	187.10	85.05	60.09	62.10	81/82	1012.4
1982	59.78	52.98	80.74	74.59	64.10	141.22	57.19	78.05	109.50	78.37	161.28	137.12	82/83	1230.3
1983	100.94	46.23	58.93	117.81	143.70	39.82	19.41	75.54	124.89	115.07	88.66	145.94	83/84	992.9
1984	64.85	76.02	69.26	49.38	124.13	51.32	108.15	43.91	100.18	58.53	108.62	150.18	84/85	1072.3
1985	72.85	101.15	102.48	109.07	65.89	92.90	80.73	107.58	86.99	117.56	126.12	92.75	85/86	1062.5
1986	77.16	36.17	83.07	63.14	98.35	111.67	114.22	106.91	148.90	89.82	49.46	87.96	86/87	967.5
1987	35.33	54.09	49.84	49.95	69.37	68.34	46.50	65.22	54.40	104.16	82.20	112.35	87/88	937.5
1988	87.47	101.48	56.32	89.79	69.71	25.77	58.37	96.70	88.72	128.75	98.42	65.60	88/89	961.5
1989	98.55	60.84	97.08	71.70	70.99	92.41	11.74	46.64	71.14	87.63	149.11	47.61	89/90	895.7
1990	107.45	53.82	56.57	90.31	81.27	36.99	77.23	16.23	62.73	158.37	138.87	102.17	90/91	1016.9
1991	80.18	53.94	94.77	107.90	87.52	22.85	123.91	60.15	84.80	145.23	64.07	86.45	91/92	899.
1992	74.01	57.52	98.07	46.40	35.60									
Mean	75.68	64.36	75.14	78.40	81.17	75.80	74.28	78.39	101.88	107.34	100.04	97.58		1010.06
STD	20.46	19.78	18.91	23.56	27.96	38.82	41.37	33.40	35.92	27.74	35.38	31.90		

Table 14 Twenty largest precipitation events Muskoka/Haliburton area, 1980-1992.

Station	Event Period Start	Event Period End	Depth of Precipitation (mm)
Paint Lake	21 Jul 80	28 Jul 80	119.5
Harp Lake	24 Aug 81	31 Aug 81	87.0
Heney Lake	14 Nov 89	21 Nov 89	83.3
Plastic Lake	21 Nov 90	28 Nov 90	79.0
Harp Lake	16 Jun 80	23 Jun 80	77.6
Harp Lake	21 Oct 91	28 Oct 91	73.6
Harp Lake	14 Nov 89	20 Nov 89	71.8
Paint Lake	09 Nov 89	16 Nov 89	70.7
Plastic Lake	17 Jul 91	24 Jul 91	70.4
Plastic Lake	23 Oct 91	30 Oct 91	70.0
Harp Lake	08 Dec 83	15 Dec 83	69.5
Plastic Lake	16 Jun 80	23 Jun 80	67.8
Paint Lake	16 Jul 91	23 Jul 91	66.8
Heney Lake	20 Nov 90	27 Nov 90	66.7
Heney Lake	29 Sep 86	06 Oct 86	65.5
Heney Lake	16 Oct 90	23 Oct 90	65.1
Heney Lake	30 Nov 82	06 Dec 82	65.1
Paint Lake	21 Oct 91	28 Oct 91	63.2
Heney Lake	22 Oct 91	29 Oct 91	62.3
Harp Lake	09 Mar 92	16 Mar 92	62.1

*Each of the sites has moved within the watershed (<1000 m) over the period 1980-1992. The sites used in this summary include PTIP for Paint Lake, PCP and PCP2 for Plastic Lake, HYP and HYP2 for Heney Lake and HPP and HPP2 for Harp Lake.

Table 15 Annual lake evaporation (m yr^{-1} and $10^3 m^3 yr^{-1}$) for 8 study lakes 1980-1992.

Watershed	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	Mean 1980-92
Annual lake evaporation ($10^3 m^3 yr^{-1}$)													
Blue Chalk	299.9	306.4	325.6	347.1	310.4	316.2	343.6	370.1	365.9	373.8	373.9	385.8	343.2
Chub	199.0	209.6	209.3	234.7	203.8	211.7	215.3	243.4	240.5	246.5	246.5	254.3	226.2
Crosson	320.1	347.4	350.9	380.2	339.3	336.5	368.4	411.4	391.5	394.4	403.1	411.4	371.2
Dickie	548.5	563.6	588.9	637.4	554.1	562.9	627.1	680.8	647.7	653.3	667.4	680.7	617.7
Harp	407.6	435.4	459.7	504.7	416.9	426.2	439.9	523.5	496.2	499.2	488.2	506.8	467.0
Heney	124.8	128.0	135.7	144.7	128.2	129.9	139.6	155.4	147.9	149.0	152.2	155.4	140.9
Plastic	178.7	190.4	196.7	207.6	189.4	186.2	207.3	236.9	224.7	225.9	221.1	229.2	207.8
Red Chalk Main	311.4	331.9	349.6	288.7	254.8	260.5	276.4						296.2
Red Chalk East				84.4	77.8	80.3	85.6						82.0
Total Red Chalk				373.1	332.6	340.8	362.0	403.1	399.4	408.5	408.5	421.6	383.3
Mean	298.8	314.1	327.1	353.7	308.1	313.8	338.3	378.1	364.2	368.8	370.1	380.7	344.7
Annual lake evaporation (m yr^{-1})													
Blue Chalk	0.573	0.585	0.622	0.663	0.593	0.604	0.656	0.707	0.699	0.714	0.714	0.737	0.656
Chub	0.580	0.611	0.608	0.682	0.594	0.617	0.625	0.707	0.701	0.716	0.716	0.739	0.658
Crosson	0.564	0.612	0.618	0.670	0.598	0.593	0.649	0.725	0.690	0.695	0.710	0.725	0.654
Dickie	0.586	0.602	0.629	0.681	0.592	0.601	0.670	0.727	0.692	0.698	0.713	0.727	0.660
Harp	0.571	0.610	0.644	0.707	0.584	0.597	0.616	0.733	0.695	0.699	0.684	0.710	0.654
Heney	0.584	0.599	0.635	0.677	0.600	0.608	0.653	0.727	0.692	0.697	0.712	0.727	0.659
Plastic	0.556	0.592	0.612	0.646	0.589	0.579	0.645	0.737	0.698	0.703	0.688	0.713	0.647
Red Chalk Main	0.545	0.581	0.612	0.655	0.578	0.591	0.627						0.598
Red Chalk East				0.647	0.596	0.615	0.656						0.629
Total Red Chalk				0.651	0.582	0.603	0.642	0.705	0.699	0.715	0.715	0.738	0.648
Mean	0.570	0.579	0.623	0.669	0.592	0.601	0.644	0.721	0.696	0.705	0.707	0.727	0.655

Table 16 Change in lake level (m yr^{-1}) for 8 study lakes.

Watershed	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	1980-92
Blue Chalk	0.022	-0.010	0.076	0.093	-0.155	0.050	-0.084	0.018	0.107	-0.143	-0.045	0.028	-0.043
Chub	-0.097	0.059	0.130	-0.024	-0.107	0.030	-0.039	0.050	0.020	-0.018	0.117	-0.106	0.015
Crosson	0.154	0.012	0.292	0.052	-0.106	-0.028	0.014	0.087	0.063	0.017	-0.315	0.138	0.380
Dickie	0.048	0.005	0.093	0.008	-0.031	0.004	-0.017	-0.015	0.019	0.028	-0.013	-0.155	-0.047
Harp	0.104	0.011	0.061	0.034	-0.138	0.094	-0.021	-0.028	0.020	-0.008	0.011	-0.028	0.112
Heney	0.041	0.015	0.047	0.002	-0.026	-0.016	0.011	0.033	-0.010	0.092	0.012	-0.042	0.243
Plastic	0.322	0.004	0.018	0.067	-0.046	-0.051	-0.113	-0.001	0.009	0.013	0.135	-0.137	0.220
Red Chalk	-0.019	-0.004	0.132	-0.043	-0.057	0.036	-0.086	0.067	0.008	0.086	-0.256	0.123	-0.013

Table 17 Annual water balances for Blue Chalk Lake 1980-1992. Individual supply and loss terms in $10^{3} m^{3} yr^{-1}$ and as % total supply or % total loss.

	1980/81	%	1981/82	%	1982/83	%	1983/84	%	1984/85	%	1985/86	%
Precip	561.024	48.473	529.970	54.086	644.082	46.952	519.819	50.845	561.365	46.989	556.214	51.628
Inlet bc1	90.586	7.826	73.293	7.480	125.388	9.140	89.577	8.761	98.917	8.279	87.225	8.096
Ungauged	505.779	43.699	376.596	38.433	602.307	43.907	412.948	40.392	534.389	44.731	433.903	40.275
TOTAL SUPPLY	1157.391	100.000	979.860	100.000	1371.779	100.000	1022.344	100.000	1194.672	100.000	1077.343	100.000
Outlet	970.367	75.703	732.096	70.861	1091.260	74.899	677.355	63.109	993.805	81.295	764.190	69.051
Evap	299.765	23.386	306.353	29.652	325.476	22.339	347.131	32.342	310.250	25.379	316.163	28.568
Lake Storage	11.666	0.910	-5.309	-0.513	40.222	2.760	48.816	4.548	-81.600	-6.675	26.343	2.380
TOTAL LOSS	1281.799	100.00	1033.139	100.000	1456.959	100.000	1073.304	100.000	1222.456	99.999	1106.697	100.000
Balance	124.408		53.278		85.180		50.959		27.783		29.353	
Balance (%)	+9.705		+5.156		+5.846		+4.747		+2.272		+2.652	

	1986/87	%	1987/88	%	1988/89	%	1989/90	%	1990/91	%	1991/92	%
Precip	506.497	53.067	491.015	51.819	503.336	50.910	468.897	50.598	532.350	49.303	470.649	51.031
Inlet bc1	64.649	6.773	66.758	7.045	70.409	7.121	64.597	6.970	80.504	7.455	60.917	6.605
Ungauged	383.302	40.159	389.779	41.135	414.927	41.968	393.215	42.431	466.896	43.241	390.698	42.362
TOTAL SUPPLY	954.449	100.000	947.553	100.000	988.673	100.000	926.709	100.000	1079.750	100.000	922.264	100.000
Outlet	706.570	70.219	654.278	63.267	673.064	61.460	696.791	69.982	820.913	70.105	625.973	60.967
Evap	343.632	34.150	370.072	35.785	365.727	33.396	373.810	37.543	373.910	31.931	385.809	37.576
Lake Storage	-43.973	-4.370	9.787	0.946	56.328	5.143	-74.935	-7.526	-23.857	-2.037	14.957	1.456
TOTAL LOSS	1006.228	100.000	1034.138	100.000	1095.120	100.000	995.666	100.000	1170.966	100.000	1026.739	99.999
Balance	51.779		86.584		106.446		68.957		91.216		104.474	
Balance (%)	+5.145		+8.372		+9.720		+6.926		+7.790		+10.175	

Overall Balance:

	Jun 1/80-May 31/92	**%**
Precip	**6345.218**	**50.268**
Inlet bc1	**972.820**	**7.706**
Ungauged	**5304.739**	**42.025**
TOTAL SUPPLY	**12622.777**	**99.999**
Outlet	**9406.662**	**69.662**
Evap	**4118.098**	**30.497**
Lake Storage	**-21.555**	**-0.160**
TOTAL LOSS	**13503.205**	**99.999**
Balance	**880.428**	
Balance (%)	**+6.520**	

Table 17 — Annual water balances for Chub Lake 1980-1992. Individual supply and loss terms in $10^3 m^3 yr^{-1}$ and as % total supply or % total loss.

	1980/81	%	1981/82	%	1982/83	%	1983/84	%	1984/85	%	1985/86	%
Precip	368.765	18.889	348.353	22.493	423.359	20.474	341.68	22.344	368.989	19.144	365.603	23.579
Inlet cb1	291.331	14.923	245.386	15.845	326.186	15.775	234.60	15.342	286.299	14.854	216.840	13.984
Inlet cb2	790.298	40.482	574.528	37.098	797.060	38.547	576.52	37.702	778.213	40.376	592.573	38.217
Ungauged	501.816	25.705	380.395	24.562	521.125	25.202	376.318	24.610	493.875	25.624	375.524	24.218
TOTAL SUPPLY	1952.211	100.000	1548.664	100.000	2067.731	99.999	1529.126	100.000	1927.377	100.000	1550.542	100.000
Outlet	1771.663	91.423	1260.224	84.535	1961.740	88.527	1420.327	86.263	1839.712	91.658	1396.315	86.237
Evap	199.574	10.298	210.243	14.103	209.253	9.443	234.702	14.254	204.256	10.176	212.250	13.108
Lake Storage	-33.377	-1.722	20.301	1.361	44.962	2.029	-8.533	-0.518	-36.841	-1.835	10.593	0.654
TOTAL LOSS	1937.860	100.000	1490.769	100.000	2215.956	100.000	1646.496	100.000	2007.127	100.000	1619.159	100.000
Balance	-14.351		-57.894		148.224		117.369		79.749		68.617	
Balance (%)	-0.740		-3.883		+6.688		+7.128		+3.973		+4.237	

	1986/87	%	1987/88	%	1988/89	%	1989/90	%	1990/91	%	1991/92	%
Precip	332.924	25.934	322.747	20.908	330.846	23.458	308.208	22.335	349.917	20.440	309.360	23.113
Inlet cb1	169.723	13.221	206.356	13.368	198.702	14.088	208.132	15.083	268.385	15.678	205.278	15.337
Inlet cb2	479.751	37.371	627.583	40.657	538.693	38.195	523.924	37.968	661.928	38.667	497.662	37.182
Ungauged	301.320	23.472	386.902	25.065	342.111	24.257	339.634	24.612	431.614	25.213	326.126	24.366
TOTAL SUPPLY	1283.719	100.000	1543.590	100.000	1410.353	100.000	1379.899	100.000	1711.846	100.000	1338.428	100.000
Outlet	1178.519	85.385	1311.550	83.406	1268.172	83.639	1243.403	83.823	1465.478	83.624	1215.429	84.808
Evap	215.282	15.597	243.430	15.480	241.052	15.898	246.451	16.614	246.516	14.066	254.344	17.747
Lake Storage	-13.567	-0.982	17.499	1.112	7.015	0.462	-6.488	-0.437	40.456	2.308	-36.622	-2.555
TOTAL LOSS	1380.234	100.000	1572.480	100.000	1516.240	100.000	1483.365	99.999	1752.451	100.000	1433.152	99.999
Balance	96.514		28.889		105.887		103.465		40.605		94.723	
Balance (%)	+6.609		+1.837		+6.983		+6.975		+2.317		+6.609	

Overall Balance:

	Jun 1/80-May 31/92	%
Precip	4170.751	21.670
Inlet cb1	2857.218	14.850
Inlet cb2	7439.733	38.660
Ungauged	4776.460	24.820
TOTAL SUPPLY	19244.162	100.000
Outlet	17332.532	86.424
Evap	2717.353	13.549
Lake Storage	5.398	0.027
TOTAL LOSS	20055.283	100.000
Balance	811.121	
Balance (%)	+4.044	

Table 17 Annual water balances for Crosson Lake 1980-1992. Individual supply and loss terms in $10^3 m^3 yr^{-1}$ and as % total supply or % total loss.

	1980/81	%	1981/82	%	1982/83	%	1983/84	%	1984/85	%	1985/86	%
Precip	608.071	15.235	574.413	19.228	698.094	15.759	563.410	16.127	608.440	14.197	602.857	17.271
Inlet cn1	2958.447	74.126	2110.030	70.634	3263.155	73.667	2562.365	73.346	3215.613	75.034	2525.267	72.346
Ungauged	424.571	10.637	302.813	10.136	468.300	10.572	367.728	10.526	461.477	10.768	362.404	10.382
TOTAL SUPPLY	3991.089	100.000	2987.257	100.000	4429.550	100.000	3493.504	100.000	4285.531	100.000	3490.529	100.000
Outlet	3949.257	90.643	2817.806	88.826	4297.631	89.270	2905.004	87.638	4216.454	93.79	3041.406	90.464
Evap	320.051	7.345	347.439	10.952	350.858	7.288	380.234	11.470	339.263	7.54	336.548	10.010
Lake Storage	87.622	2.011	6.997	0.220	165.680	3.441	29.504	0.890	-60.549	-1.34	-15.968	-0.474
TOTAL LOSS	4356.931	99.999	3172.243	99.999	4814.170	100.000	3314.743	100.000	4495.168	100.000	3361.986	100.000
Balance	365.841		184.986		384.620		-178.761		209.637		-128.543	
Balance (%)	+8.396		+5.831		+7.989		-5.392		+4.663		-3.823	

	1986/87	%	1987/88	%	1988/89	%	1989/90	%	1990/91	%	1991/92	%
Precip	548.971	19.095	532.191	17.716	545.545	17.046	508.217	15.671	576.992	16.104	510.117	18.762
Inlet cn1	2034.021	70.751	2161.583	71.957	2321.576	72.542	2391.540	73.745	2628.526	73.366	1931.451	71.041
Ungauged	291.905	10.153	310.212	10.326	333.173	10.410	343.213	10.583	377.223	10.528	277.185	10.195
TOTAL SUPPLY	2874.899	100.000	3003.986	100.000	3200.295	99.999	3242.971	100.000	3582.742	100.000	2718.754	100.000
Outlet	2741.477	87.918	2566.186	84.771	2875.846	87.067	2899.195	87.767	3345.567	93.715	2476.572	83.485
Evap	368.410	11.814	411.302	13.586	391.335	11.847	394.433	11.940	403.097	11.291	411.206	13.861
Lake Storage	8.332	0.267	49.693	1.641	35.827	1.084	9.645	0.292	-178.730	-5.006	78.706	2.653
TOTAL LOSS	3118.221	100.000	3027.182	100.000	3303.009	100.000	3303.275	100.000	3569.934	100.000	2966.484	100.000
Balance	243.322		23.195		102.714		60.303		-12.808		247.730	
Balance (%)	+7.803		+0.766		+3.109		+1.825		-0.358		+8.350	

Overall Balance:

	Jun 1/80-May 31/92	%
Precip	6877.318	16.652
Inlet cn1	30103.574	72.888
Ungauged	4320.204	10.460
TOTAL SUPPLY	41301.096	100.000
Outlet	38132.401	89.088
Evap	4454.176	10.406
Lake Storage	216.759	0.506
TOTAL LOSS	42803.336	100.000
Balance	1502.240	
Balance (%)	+3.510	

Table 17 Annual water balances for Dickie Lake 1980-1992. Individual supply and loss terms in $10^3 m^3 yr^{-1}$ and as % total supply or % total loss.

	1980/81	%	1981/82	%	1982/83	%	1983/84	%	1984/85	%	1985/86	%
Precip	1003.092	25.956	947.568	30.596	1151.598	27.910	929.418	30.607	1003.701	28.296	994.491	32.836
Inlet de5	233.149	6.033	136.442	4.405	214.420	5.196	163.710	5.391	196.606	5.542	161.380	5.328
Inlet de6	165.693	4.272	115.130	3.717	162.389	3.935	125.113	4.120	146.998	4.144	105.155	3.472
Inlet de8	508.337	13.154	398.381	12.863	521.848	12.647	374.693	12.339	425.376	11.992	352.989	11.655
Inlet de10	530.694	13.735	408.809	12.585	572.832	12.919	394.929	13.006	470.407	13.381	377.281	12.350
Inlet de11	490.523	12.693	389.765	12.585	533.065	12.919	361.665	11.910	474.660	13.381	374.045	12.350
Ungauged	933.009	24.143	700.836	22.630	969.856	23.505	687.087	22.626	829.302	23.380	663.254	21.899
TOTAL SUPPLY	3864.500	99.984	3096.934	99.385	4126.011	99.036	3036.618	99.999	3547.054	100.119	3028.598	99.893
Outlet	3536.308	85.627	2449.877	81.157	3452.151	83.620	2498.376	79.489	3230.333	86.030	2492.034	81.466
Evap	548.510	13.281	563.585	18.669	588.909	14.264	637.012	20.267	553.944	14.752	562.919	18.402
Lake Storage	45.061	1.091	5.214	0.172	87.315	2.115	7.621	0.242	-29.417	-0.783	4.011	0.131
TOTAL LOSS	4129.880	100.000	3018.677	100.000	4128.376	100.000	3143.010	99.999	3754.861	100.000	3058.965	100.000
Balance	265.380		-78.257		2.365		106.392		207.806		30.366	
Balance (%)	+6.425		-2.592		+0.057		+3.385		+5.534		+0.992	

	1986/87	%	1987/88	%	1988/89	%	1989/90	%	1990/91	%	1991/92	%
Precip	905.600	35.898	877.919	32.260	899.948	33.307	838.370	30.952	951.824	28.446	841.504	31.026
Inlet de5	120.185	4.764	120.350	4.422	132.666	4.910	150.452	5.554	185.480	5.543	140.466	5.179
Inlet de6	92.305	3.658	103.115	3.789	102.284	3.785	101.872	3.761	149.023	4.453	116.031	4.278
Inlet de8	264.432	10.482	309.224	11.362	303.488	11.232	311.301	11.493	368.916	11.025	295.721	10.903
Inlet de10	323.787	11.460	362.175	12.769	343.782	12.295	341.295	13.123	460.770	13.428	381.360	12.062
Inlet de11	289.103	11.460	347.500	12.769	332.214	12.295	355.472	13.123	449.317	13.428	327.162	12.062
Ungauged	527.280	20.901	601.089	22.087	587.576	21.746	609.812	22.514	780.657	23.331	609.980	22.490
TOTAL SUPPLY	2522.694	98.625	2721.374	99.460	2701.960	99.571	2708.578	100.523	3345.990	99.657	2712.226	98.001
Outlet	1860.529	75.276	2018.475	75.168	1907.996	74.119	1831.111	72.933	2849.075	81.321	2416.474	81.858
Evap	626.959	25.366	680.818	25.353	647.618	25.157	653.084	26.012	667.246	19.045	680.743	23.060
Lake Storage	-15.911	-0.643	-14.040	-0.522	18.612	0.723	26.475	1.054	-12.836	-0.366	-145.213	-4.919
TOTAL LOSS	2471.577	100.000	2685.253	100.000	2574.227	100.000	2510.671	100.000	3503.485	100.000	2952.004	99.999
Balance	-51.116		-36.120		-127.732		-197.907		157.494		239.777	
Balance (%)	-2.068		-1.345		-4.961		-7.882		+4.495		+8.122	

Overall Balance:

	Jun 1/80- May 31/92	%
Precip	11356.322	30.345
Inlet de5	1955.306	5.248
Inlet de6	1485.108	3.968
Inlet de8	4,434.706	11.850
Inlet de10	4,968.121	13.275
Inlet de11	4724.491	12.624
Ungauged	8499.738	22.712
TOTAL SUPPLY	37423.792	100.022
Outlet	30542.739	80.522
Evap	7411.347	19.539
Lake Storage	-23.108	-0.061
TOTAL LOSS	37930.978	100.000
Balance	507.186	
Balance (%)	+1.337	

Table 17 Annual water balances for Harp Lake 1980-1992. Individual supply and loss terms in $10^3 m^3 yr^{-1}$ and as % total supply or % total loss.

	1980/81	%	1981/82	%	1982/83	%	1983/84	%	1984/85	%	1985/86	%
Precip	764.965	19.039	722.622	19.618	878.216	21.373	708.781	22.807	765.430	18.520	758.406	18.864
Inlet hp3	189.856	4.725	176.602	4.794	189.106	4.602	146.183	4.703	184.376	4.461	186.278	4.633
Inlet hp3a	141.341	3.517	126.783	3.442	134.540	3.274	105.110	3.382	134.885	3.263	142.001	3.532
Inlet hp4	785.326	19.546	664.718	18.046	713.392	17.362	562.925	18.113	770.944	18.653	780.482	19.413
Inlet hp5	1344.117	33.454	1277.690	34.687	1406.724	34.235	1004.454	32.321	1470.855	35.588	1365.590	33.966
Inlet hp6	70.083	1.744	69.825	1.895	71.079	1.729	53.680	1.727	69.918	1.691	75.055	1.866
Inlet hp6A	99.065	2.465	78.128	2.121	97.119	2.363	67.144	2.160	91.614	2.216	87.830	2.184
Ungauged	622.961	15.505	567.046	15.394	618.738	15.058	459.441	14.783	644.945	15.604	624.725	15.539
TOTAL SUPPLY	4017.718	100.000	3683.417	99.999	4108.919	100.000	3107.721	100.000	4132.970	100.000	4020.371	100.000
Outlet	3301.850	87.258	2991.500	87.089	3526.717	87.501	2569.343	82.917	3707.645	92.099	3626.108	88.013
Evap	407.503	10.769	435.430	12.676	459.582	11.402	504.666	16.286	416.876	10.355	426.199	10.344
Lake Storage	74.643	1.972	8.055	0.234	44.153	1.095	24.677	0.796	-98.810	-2.454	67.641	1.641
TOTAL LOSS	3783.996	100.000	3434.987	100.000	4030.454	100.000	3098.687	100.000	4025.711	100.000	4119.949	100.000
Balance	-233.721		-248.430		-78.464		-9.034		-107.259		99.578	
Balance (%)	-6.176		-7.232		-1.946		-0.291		-2.664		+2.416	

	1986/87	%	1987/88	%	1988/89	%	1989/90	%	1990/91	%	1991/92	%
Precip	690.617	25.092	669.507	22.512	686.306	22.493	639.347	23.593	725.867	21.396	641.737	22.788
Inlet hp3	115.717	4.204	131.613	4.425	133.338	4.370	115.810	4.273	147.928	4.360	117.334	4.166
Inlet hp3a	81.666	2.967	96.787	3.254	103.462	3.391	87.089	3.213	116.725	3.440	89.790	3.188
Inlet hp4	490.496	17.821	533.251	17.930	544.246	17.837	499.852	18.445	631.428	18.612	528.683	18.773
Inlet hp5	875.190	31.798	999.341	33.603	1014.154	33.239	874.650	32.276	1130.676	33.329	918.796	32.626
Inlet hp6	47.402	1.722	47.239	1.588	51.814	1.698	43.851	1.618	54.953	1.619	44.843	1.592
Inlet hp6A	56.366	2.047	54.861	1.844	64.851	2.125	52.730	1.945	74.150	2.185	58.462	2.076
Ungauged	394.851	14.346	441.341	14.840	452.895	14.843	396.543	14.633	510.694	15.053	416.424	14.787
TOTAL SUPPLY	2752.308	100.000	2973.943	99.999	3051.069	100.000	2709.874	100.000	3392.425	100.000	2816.072	100.000
Outlet	2407.864	85.000	2429.104	82.848	2497.358	83.015	2297.697	82.327	2989.486	85.754	2346.378	82.83
Evap	439.905	15.529	523.450	17.853	496.233	16.495	499.217	17.887	488.174	14.003	506.498	17.88
Lake Storage	-14.989	-0.529	-20.557	-0.701	14.704	0.488	-5.995	-0.214	8.422	0.241	-20.224	-0.71
TOTAL LOSS	2832.780	99.999	2931.998	100.000	3008.296	100.000	2790.918	100.000	3486.083	100.000	2832.652	99.99
Balance	80.472		-41.944		-42.773		81.044		93.658		16.579	
Balance (%)	+2.840		-1.430		-1.421		+2.903		+2.686		+0.585	

Overall Balance:

	Jun 1/80-May 31/92	%
Precip	8651.801	20.209
Inlet hp3	1834.141	4.305
Inlet hp3a	3194.425	7.499
Inlet hp4	7505.743	17.619
Inlet hp5	13682.237	32.117
Inlet hp6	699.742	1.643
Inlet hp6A	882.320	2.071
Ungauged	6150.604	14.438
TOTAL SUPPLY	42601.013	100.001
Outlet	34691.050	85.919
Evap	5603.733	13.879
Lake Storage	81.720	0.202
TOTAL LOSS	40376.503	100.000
Balance	-2224.510	
Balance (%)	-5.509	

Table 17 Annual water balances for Heney Lake 1980-1992. Individual supply and loss terms in $10^6 m^3 yr^{-1}$ and as % total supply or % total loss.

	1980/81	%	1981/82	%	1982/83	%	1983/84	%	1984/85	%	1985/86	%
Precip	229.018	31.220	216.341	36.340	262.923	33.392	212.197	36.351	229.157	33.818	227.054	38.765
Ungauged	504.523	68.779	378.976	63.659	524.448	66.607	371.541	63.648	448.444	66.181	358.653	61.234
TOTAL SUPPLY	733.541	100.000	595.317	100.000	787.372	100.000	583.739	100.000	677.601	100.000	585.708	100.000
Outlet	657.262	83.110	417.981	76.082	614.245	80.800	444.562	75.393	628.939	83.703	483.512	79.280
Evap	124.709	15.769	128.042	23.306	135.727	17.854	144.577	24.518	128.188	17.060	129.936	21.305
Lake Storage	8.853	1.119	3.358	0.611	10.227	1.345	0.518	0.088	-5.739	-0.763	-3.571	-0.585
TOTAL LOSS	790.825	100.000	549.382	100.000	760.199	100.000	589.658	100.000	751.387	100.000	609.877	100.000
Balance	57.283		-45.935		-27.173		5.919		73.786		24.169	
Balance (%)	+7.243		-8.361		-3.574		+1.003		+9.820		+3.963	

	1986/87	%	1987/88	%	1988/89	%	1989/90	%	1990/91	%	1991/92	%
Precip	206.759	42.034	200.439	38.144	205.468	39.271	191.410	36.727	217.312	33.984	192.125	36.807
Ungauged	285.126	57.965	325.038	61.855	317.730	60.728	329.755	63.272	422.139	66.015	329.845	63.192
TOTAL SUPPLY	491.885	100.000	525.477	99.999	523.199	100.000	521.165	100.000	639.452	100.000	521.971	100.000
Outlet	371.068	72.309	402.436	75.110	441.489	75.197	332.544	66.337	467.185	75.104	365.244	71.409
Evap	139.593	27.202	155.336	28.991	147.767	25.168	148.998	29.722	152.233	24.473	155.304	30.363
Lake Storage	2.503	0.487	-21.980	-4.102	-2.149	-0.366	19.752	3.940	2.625	0.422	-9.066	-1.772
TOTAL LOSS	513.165	100.000	535.792	100.000	587.107	100.000	501.294	100.000	622.044	100.000	511.481	100.000
Balance	21.279		10.314		63.908		-19.870		-17.407		-10.489	
Balance (%)	+4.146		+1.925		+10.885		-3.963		-2.798		-2.050	

Overall Balance:

	Jun 1/80- May 31/92	**%**
Precip	**2590.203**	**36.043**
Ungauged	**4596.218**	**63.957**
TOTAL SUPPLY	**7186.421**	**100.000**
Outlet	**5626.467**	**76.841**
Evap	**1690.410**	**23.086**
Lake Storage	**5.331**	**0.073**
TOTAL LOSS	**7322.208**	**100.999**
Balance	**135.787**	
Balance (%)	**+1.854**	

Table 17 Annual water balances for Plastic Lake 1980-1992. Individual supply and loss terms in $10^3 m^3 yr^{-1}$ and as % total supply or % total loss.

	1980/81	%	1981/82	%	1982/83	%	1983/84	%	1984/85	%	1985/86	%
Precip	344.437	36.176	325.372	41.592	395.431	33.931	319.140	37.445	344.647	36.294	341.484	41.591
Inlet pc1	148.510	15.598	111.670	14.274	188.176	16.147	130.299	15.288	147.844	15.569	117.203	14.274
Ungauged	459.149	48.225	345.250	44.133	581.782	49.921	402.846	47.266	457.088	48.135	362.358	44.133
TOTAL SUPPLY	952.098	100.000	782.293	100.000	1165.390	100.000	852.286	100.000	949.580	100.000	821.046	100.000
Outlet	627.979	68.998	567.715	74.758	909.253	81.783	607.120	72.596	762.477	81.370	614.683	78.354
Evap	178.603	19.623	190.393	25.071	196.738	17.695	207.491	24.810	189.400	20.212	186.196	23.734
Lake Storage	103.553	11.377	1.285	0.169	5.785	0.520	21.686	2.593	-14.837	-1.583	-16.391	-2.089
TOTAL LOSS	910.136	99.999	759.394	100.000	1111.777	100.000	836.298	100.000	937.040	100.000	784.488	100.000
Balance	-41.961		-22.899		-53.612		-15.987		-12.539		-36.558	
Balance (%)	-4.610		-3.015		-4.822		-1.911		-1.338		-4.660	

	1986/87	%	1987/88	%	1988/89	%	1989/90	%	1990/91	%	1991/92	%
Precip	310.961	41.408	301.456	41.323	309.020	39.477	287.876	36.732	326.833	36.821	288.952	41.650
Inlet pc1	107.533	14.319	104.613	14.340	115.784	14.791	121.179	15.462	137.052	15.440	98.933	14.260
Ungauged	332.459	44.271	323.431	44.336	357.968	45.730	374.648	47.804	423.722	47.737	305.871	44.089
TOTAL SUPPLY	750.954	100.000	729.501	100.000	782.772	100.000	783.704	100.000	887.608	100.000	693.757	100.000
Outlet	630.310	78.670	507.107	68.204	555.755	70.939	579.473	71.576	664.617	71.534	549.015	74.785
Evap	207.210	25.862	236.939	31.867	224.520	28.658	225.931	27.907	220.975	23.784	229.248	31.227
Lake Storage	-36.318	-4.532	-0.535	-0.072	3.149	0.402	4.178	0.516	43.496	4.681	-44.138	-6.012
TOTAL LOSS	801.202	100.000	743.511	100.000	783.425	100.000	809.582	100.000	929.089	99.999	734.125	100.000
Balance	50.247		14.009		0.652		25.878		41.480		40.368	
Balance (%)	+6.271		+1.884		+0.083		+3.196		+4.464		+5.498	

Overall Balance:

	Jun 1/80- May 31/92	%
Precip	3895.609	38.377
Inlet pc1	1528.796	15.061
Ungauged	4726.572	46.563
TOTAL SUPPLY	10150.977	100.001
Outlet	7575.504	74.709
Evap	2493.644	24.592
Lake Storage	70.913	0.699
TOTAL LOSS	10140.061	100.000
Balance	-10.916	
Balance (%)	-0.108	

Table 17 Annual water balances for Red Chalk Lake 1980-1992. Individual supply and loss terms in $10^3 m^3 yr^{-1}$ and as % total supply or % total loss.

	1980/81	%	1981/82	%	1982/83	%	1983/84	%	1984/85	%	1985/86	%
Precip	612.250	15.943	578.361	19.366	702.893	15.806	567.283	18.642	612.622	15.389	607.001	18.500
Inlet rc1	777.832	20.254	552.507	18.500	958.494	21.555	622.321	20.451	806.338	20.255	643.195	19.603
Inlet rc2	162.196	4.223	123.573	4.137	197.522	4.441	141.545	4.651	160.956	4.043	131.530	4.008
Inlet rc3	479.990	12.499	347.739	11.643	491.677	11.057	348.323	11.446	489.756	12.303	404.361	12.324
Inlet rc4	245.839	6.401	210.712	7.055	318.578	7.164	232.298	7.633	299.830	7.532	240.526	7.330
Inlet bc0	970.367	25.268	732.096	24.514	1091.260	24.540	677.355	22.259	993.805	24.965	764.190	23.291
Ungauged	591.736	15.408	441.436	14.781	686.304	15.433	453.830	14.914	617.429	15.510	490.184	14.940
TOTAL SUPPLY	3840.214	100.000	2986.426	100.000	4446.730	100.000	3042.957	99.999	3980.739	99.999	3280.989	100.000
Outlet	3719.736	92.529	2986.573	90.066	4347.577	91.093	2975.278	89.488	3642.300	92.450	2953.508	89.190
Evap	311.593	7.751	331.803	10.006	349.589	7.324	374.443	11.262	330.424	8.386	337.343	10.187
Lake Storage	-11.289	-0.280	-2.407	-0.072	75.486	1.581	-24.957	-0.750	-32.999	-0.837	20.607	0.622
TOTAL LOSS	4020.039	100.000	3315.969	99.999	4772.653	100.000	3324.764	100.000	3939.725	100.000	3311.459	100.000
Balance	179.825		329.542		325.922		281.807		-41.013		30.469	
Balance (%)	+4.473		+9.938		+6.828		+8.476		-1.041		+0.920	

	1986/87	%	1987/88	%	1988/89	%	1989/90	%	1990/91	%	1991/92	%
Precip	552.745	18.619	535.849	18.397	549.295	18.000	511.710	17.300	580.958	16.728	513.623	17.915
Inlet rc1	572.397	19.281	585.843	20.113	633.508	20.759	595.371	20.128	709.763	20.437	593.906	20.716
Inlet rc2	114.011	3.840	120.891	4.150	129.893	4.256	124.805	4.219	146.449	4.216	117.999	4.115
Inlet rc3	375.602	12.652	360.145	12.364	388.773	12.739	357.054	12.071	422.729	12.172	376.402	13.129
Inlet rc4	204.450	6.886	219,965	7.551	218.353	7.155	223.709	7.563	261.966	7.543	207.570	7.240
Inlet bc0	706.570	23.801	654.278	22.463	673.064	22.056	696.790	23.557	820.912	23.637	625.973	21.834
Ungauged	442.873	14.918	435.711	14.959	458.712	15.031	448.417	15.160	530.142	15.265	431.385	15.047
TOTAL SUPPLY	2968.651	100.000	2912.685	99.999	3051.601	99.999	2957.860	99.999	3472.922	100.000	2866.860	99.999
Outlet	2661.050	89.587	2551.725	85.242	2738.222	87.139	2708.877	85.554	3245.911	92.537	2616.574	84.181
Evap	358.597	12.072	403.063	13.464	399.390	12.709	408.268	12.894	408.330	11.641	421.322	13.554
Lake Storage	-49.294	-1.659	38.717	1.293	4.722	0.150	49.131	1.551	-146.579	-4.178	70.351	2.263
TOTAL LOSS	2970.353	100.000	2993.507	99.999	3142.335	99.999	3166.277	100.000	3507.663	100.000	3108.248	100.000
Balance	1.701		80.821		90.733		208.417		34.740		241.388	
Balance (%)	+0.057		+2.699		+2.887		+6.582		+0.990		+7.766	

Overall Balance:

	Jun 1/80-May 31/92	%
Precip	6924.590	17.395
Inlet rc1	8051.475	20.226
Inlet rc2	1671.370	4.199
Inlet rc3	4842.551	12.165
Inlet rc4	2883.799	7.244
Inlet bc0	9406.660	23.629
Ungauged	6028.159	15.143
TOTAL SUPPLY	39808.604	100.000
Outlet	37147.331	89.355
Evap	4434.165	10.666
Lake Storage	8.511	-0.021
TOTAL LOSS	41572.985	100.000
Balance	1764.381	
Balance (%)	+4.244	

Table 18 Flushing rate and residence time (years) for 8 study lakes, 1980-1992.

Watershed	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90	1990-91	1991-92	Mean 1980-92
Flushing Rate													
Blue Chalk	4.60	6.10	4.09	6.59	4.49	5.85	6.32	6.83	6.64	6.41	5.44	7.14	5.88
Chub	1.72	2.41	1.55	2.14	1.65	2.18	2.58	2.32	2.40	2.45	2.08	2.50	2.17
Crosson	1.32	1.85	1.21	1.80	1.24	1.71	1.90	2.03	1.81	1.80	1.56	2.11	1.70
Dickie	1.32	1.90	1.35	1.87	1.44	1.87	2.51	2.31	2.45	2.55	1.64	1.93	1.93
Harp	2.88	3.18	2.70	3.70	2.56	2.62	3.95	3.91	3.81	4.14	3.18	4.05	3.39
Heney	1.08	1.69	1.15	1.59	1.13	1.46	1.91	1.76	1.60	2.13	1.52	1.94	1.58
Plastic	4.02	4.45	2.78	4.16	3.31	4.11	4.01	4.98	4.54	4.36	3.80	4.60	4.09
Red Chalk	2.18	2.71	1.86	2.72	2.22	2.74	3.04	3.17	2.96	2.99	2.49	3.09	2.68
Residence Time													
Blue Chalk	3.48	4.32	3.07	4.16	3.65	4.04	4.44	4.32	4.08	4.49	3.81	4.35	4.02
Chub	1.57	2.04	1.37	1.85	1.52	1.88	2.20	1.94	2.01	2.05	1.74	2.12	1.86
Crosson	1.20	1.64	1.08	1.57	1.16	1.55	1.67	1.72	1.58	1.58	1.46	1.76	1.50
Dickie	1.13	1.55	1.13	1.48	1.24	1.53	1.89	1.74	1.81	1.86	1.33	1.58	1.52
Harp	2.51	2.77	2.36	3.07	2.36	2.31	3.36	3.24	3.16	3.41	2.73	3.36	2.89
Heney	0.90	1.29	0.93	1.20	0.94	1.16	1.38	1.32	1.21	1.41	1.14	1.38	1.19
Plastic	2.77	3.32	2.27	3.02	2.69	3.22	3.15	3.40	3.22	3.12	2.72	3.44	3.03
Red Chalk	2.06	2.52	1.70	2.44	2.06	2.45	2.73	2.71	2.58	2.56	2.31	2.61	2.39

Figure 1

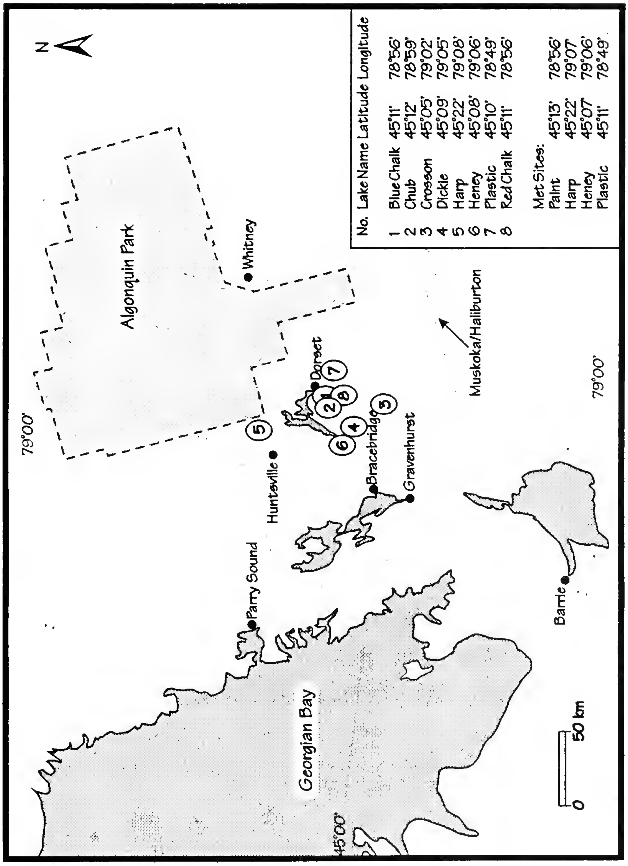
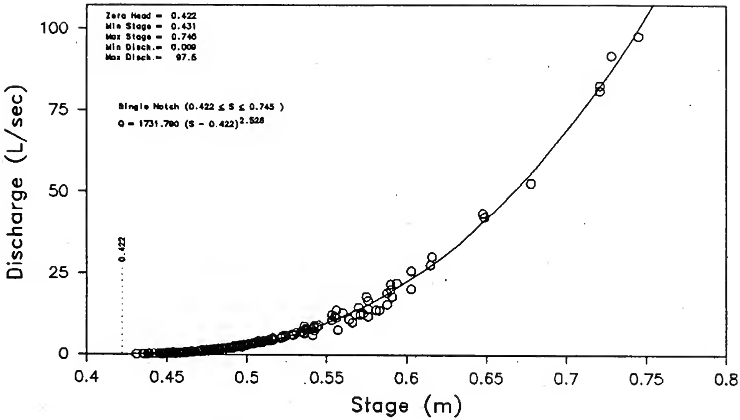

N
No. Lake Name Latitude Longitude
1 BlueChalk 45°11' 78°56'
2 Chub 45°12' 78°59'
3 Crosson 45°05' 79°02'
4 Dickie 45°09' 79°05'
5 Harp 45°22' 79°08'
6 Heney 45°08' 79°06'
7 Plastic 45°10' 78°49'
8 Red Chalk 45°11' 78°56'
Met Sites:
Paint 45°13' 78°56'
Harp 45°22' 79°07'
Heney 45°07' 79°06'
Plastic 45°11' 78°49'
Algonquin Park
Whitney
Dorset
Muskoka/Haliburton
79°00'
Huntsville
Bracebridge
Gravenhurst
Parry Sound
Barrie
Georgian Bay
45°00'
0 50 km

Figure 2. Discharge stage calibration for 34 streams, 1980-1992.

Blue Chalk 1, Blue Chalk Outflow
Chub 1, Chub 2
Chub Outflow
Crosson 1, Crosson Outflow
Dickie 5, Dickie 6
Dickie 8 (Aug 81 - Dec 83, Aug 81 - Jun 89)
Dickie 10, Dickie 11
Dickie Outflow (Aug 79 - Jul 89, Sep 80 - Dec 92)
Harp 3, Harp 3a
Harp 4, Harp 4_21
Harp 5, Harp 6
Harp 6a, Harp Outflow
Heney Outflow
Plastic 1, Plastic 1_08
Plastic Outflow
Red Chalk 1, Red Chalk 2
Red Chalk 3 (Sep 81 - Jan 90, Oct 91 - Dec 92)
Red Chalk 4
Red Chalk Outflow (Dec 79 - Oct 83, Nov 83 - May 89)
Twelve Mile South, Twelve Mile North
Beech 1, Paint Lake 1

Figure 2

Discharge–Stage Calibration for
BLUE CHALK 1



Discharge–Stage Calibration for
BLUE CHALK OUTFLOW

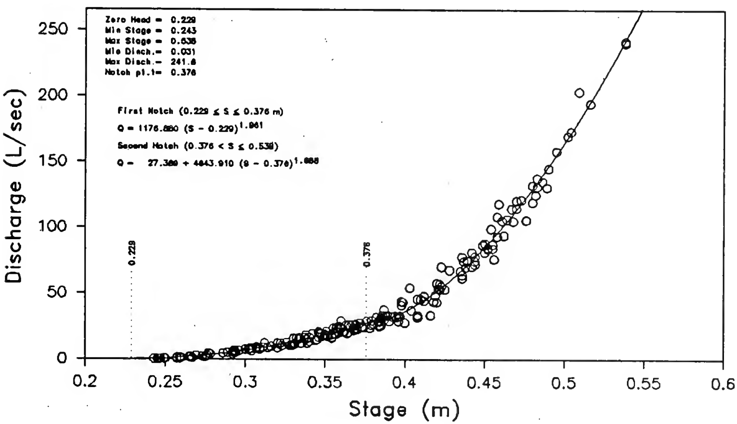
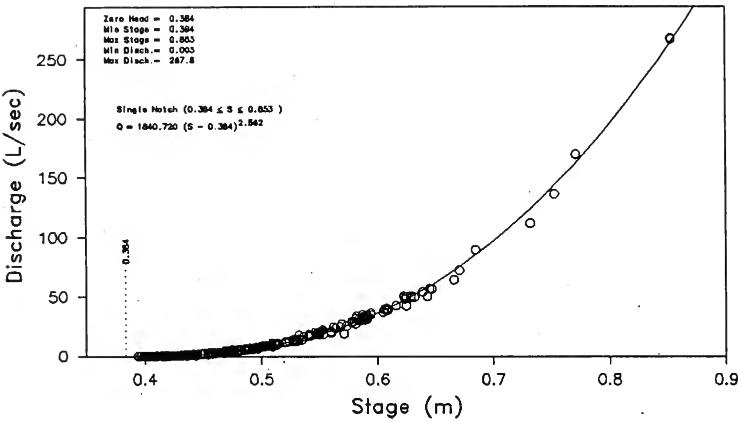


Figure 2

Discharge–Stage Calibration for CHUB 1



Discharge–Stage Calibration for CHUB 2

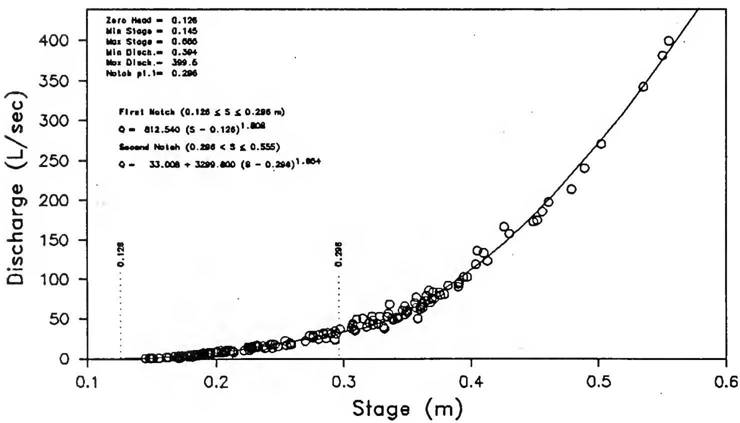


Figure 2

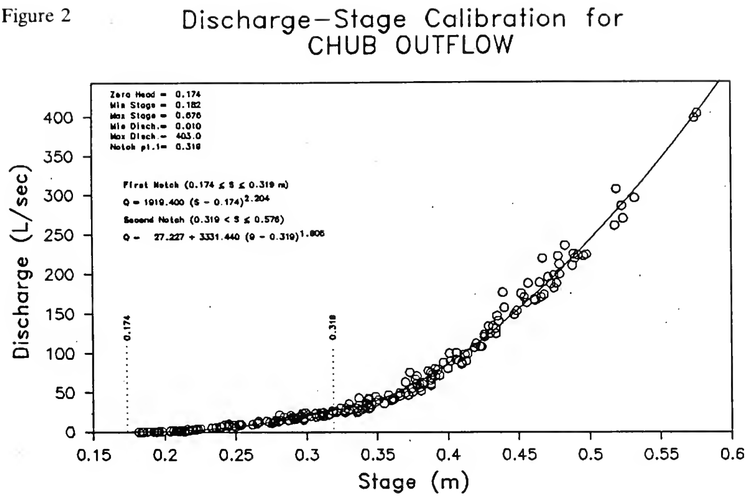
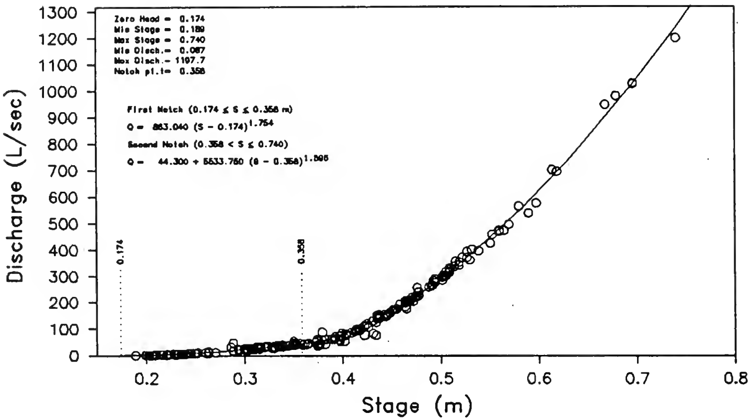

Discharge–Stage Calibration for
CHUB OUTFLOW
Zero Head = 0.174
Min Stage = 0.182
Max Stage = 0.676
Min Disch.= 0.010
Max Disch.= 403.0
Notch pt.1= 0.319
First Notch (0.174 ≤ S ≤ 0.319 m)
Q = 1919.400 (S − 0.174)^2.204
Second Notch (0.319 < S ≤ 0.576)
Q = 27.227 + 3331.440 (S − 0.319)^1.806
0.174
0.319
Discharge (L/sec)
0
50
100
150
200
250
300
350
400
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
Stage (m)

Figure 2

Discharge–Stage Calibration for CROSSON 1



Discharge–Stage Calibration for CROSSON OUTFLOW

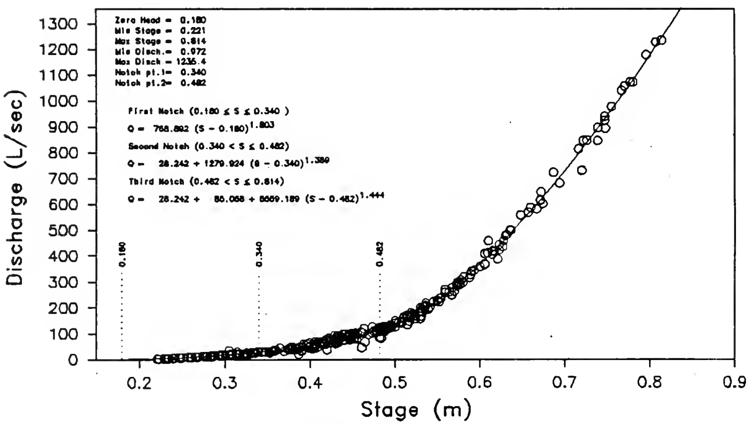
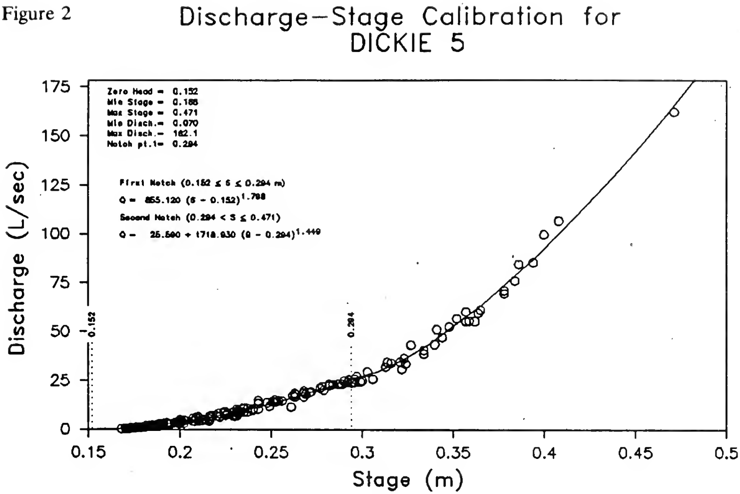


Figure 2


Discharge-Stage Calibration for DICKIE 5
Zero Head = 0.152
Min Stage = 0.168
Max Stage = 0.471
Min Disch.= 0.070
Max Disch.= 162.1
Notch pt.1= 0.294
First Notch (0.152 ≤ S ≤ 0.294 m)
Q = 855.120 (S - 0.152)^1.708
Second Notch (0.294 < S ≤ 0.471)
Q = 25.580 + 1718.930 (S - 0.294)^1.449
0.152
0.294
Discharge (L/sec)
Stage (m)
175
150
125
100
75
50
25
0
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5

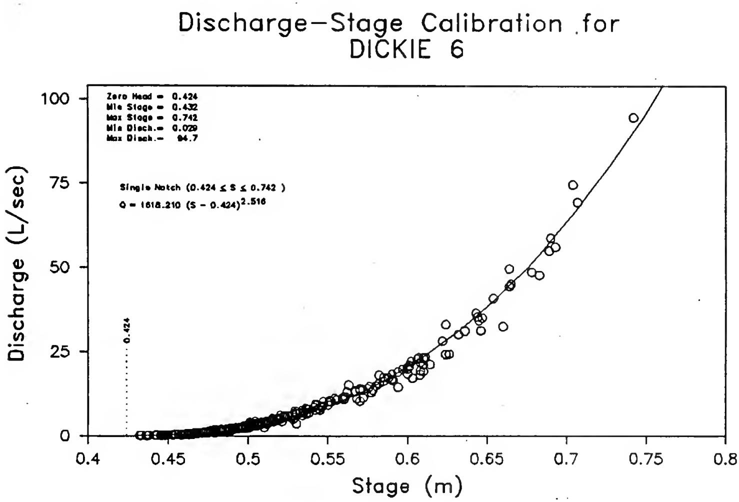
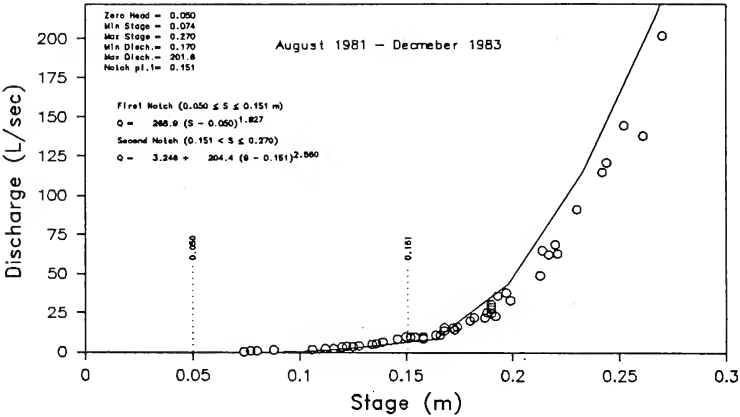

Discharge-Stage Calibration for DICKIE 6
Zero Head = 0.424
Min Stage = 0.432
Max Stage = 0.742
Min Disch.= 0.029
Max Disch.= 94.7
Single Notch (0.424 ≤ S ≤ 0.742)
Q = 1618.210 (S - 0.424)^2.516
0.424
Discharge (L/sec)
Stage (m)
100
75
50
25
0
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8

Figure 2

Discharge–Stage Calibration for DICKIE 8



Discharge–Stage Calibration for DICKIE 8

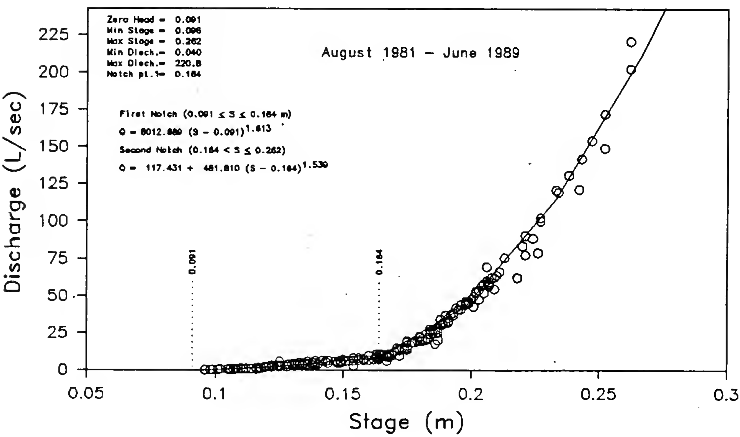
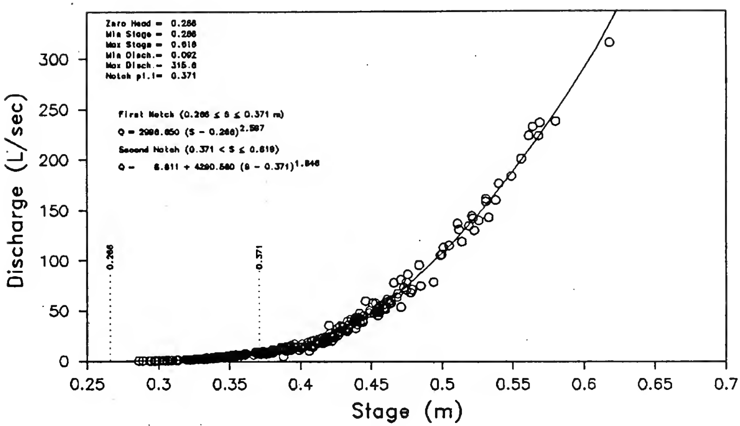


Figure 2

Discharge–Stage Calibration for DICKIE 10



Discharge–Stage Calibration for DICKIE 11

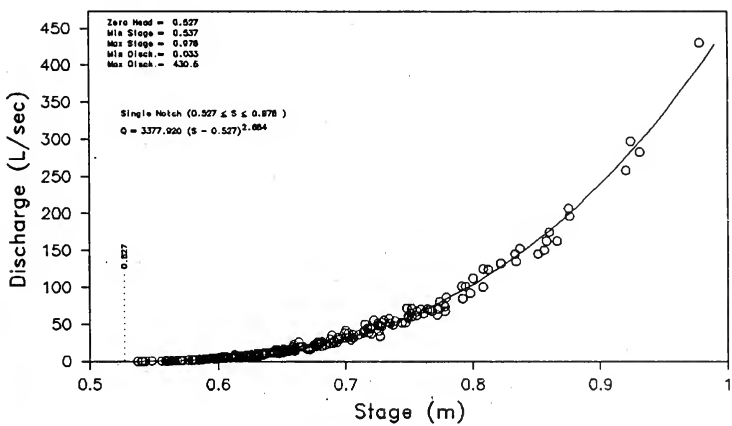
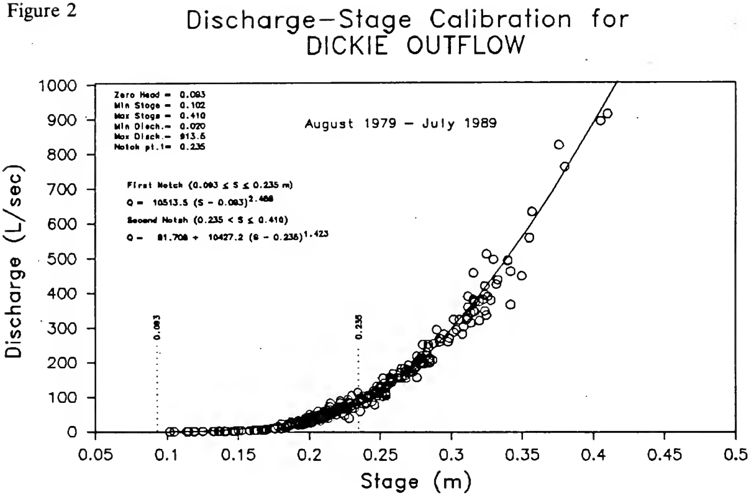


Figure 2


Discharge-Stage Calibration for
DICKIE OUTFLOW
August 1979 - July 1989
Zero Head = 0.093
Min Stage = 0.102
Max Stage = 0.410
Min Disch. = 0.020
Max Disch. = 913.6
Notch pt.1 = 0.235
First Notch (0.093 ≤ S ≤ 0.235 m)
Second Notch (0.235 < S ≤ 0.410)
Q = 81.708 + 10427.2 (S - 0.235)^1.423
0.093
0.235
Discharge (L/sec)
Stage (m)
0
100
200
300
400
500
600
700
800
900
1000
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5

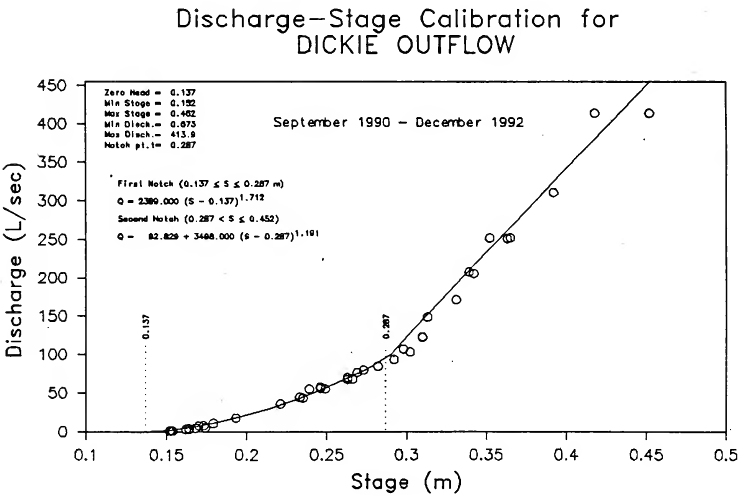
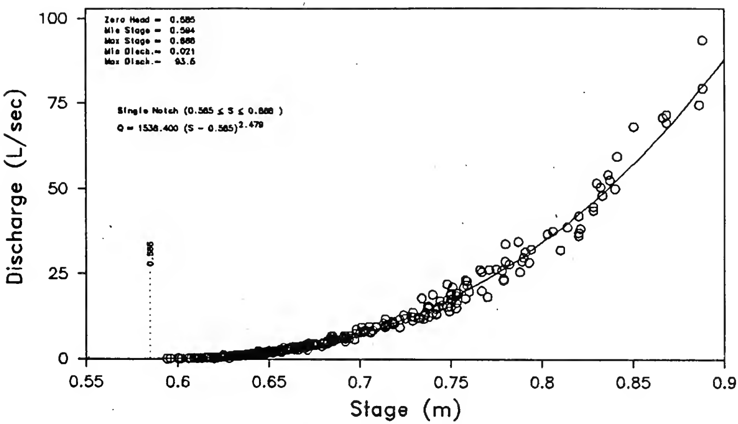

Discharge-Stage Calibration for
DICKIE OUTFLOW
September 1990 - December 1992
Zero Head = 0.137
Min Stage = 0.152
Max Stage = 0.462
Min Disch. = 0.673
Max Disch. = 413.9
Notch pt.1 = 0.287
First Notch (0.137 ≤ S ≤ 0.287 m)
Second Notch (0.287 < S ≤ 0.452)
0.137
0.287
Discharge (L/sec)
Stage (m)
0
50
100
150
200
250
300
350
400
450
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5

Figure 2

Discharge–Stage Calibration for HARP 3



Discharge–Stage Calibration for HARP 3A

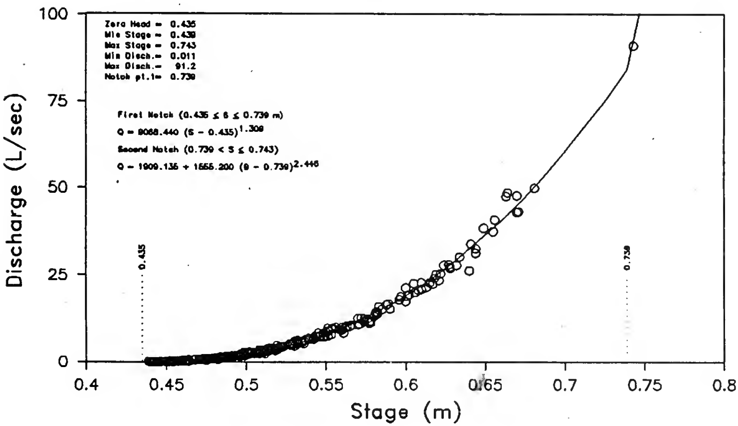
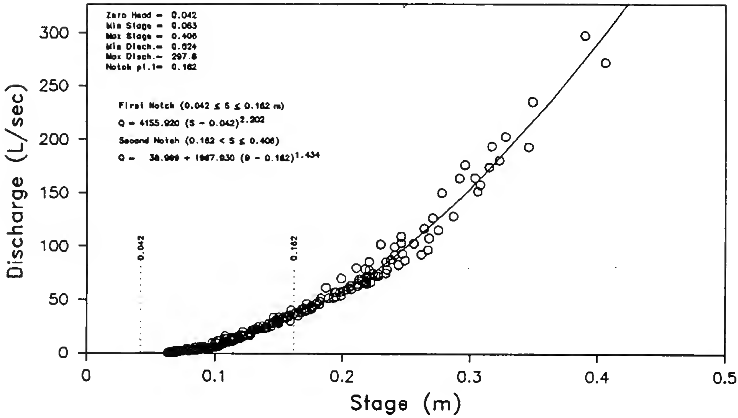


Figure 2

Discharge–Stage Calibration for HARP 4



Discharge–Stage Calibration for HARP 4_21

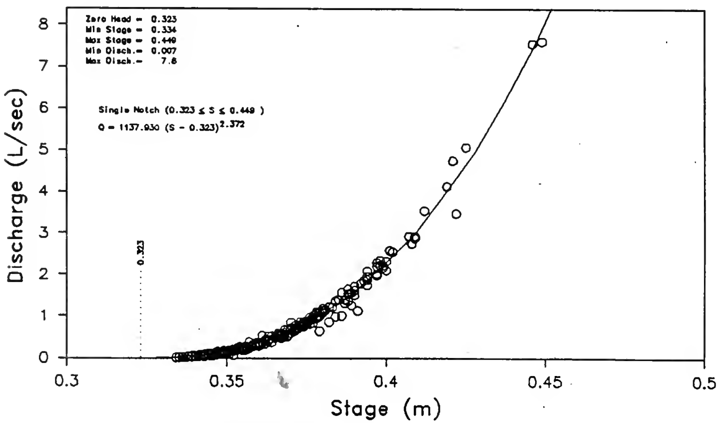
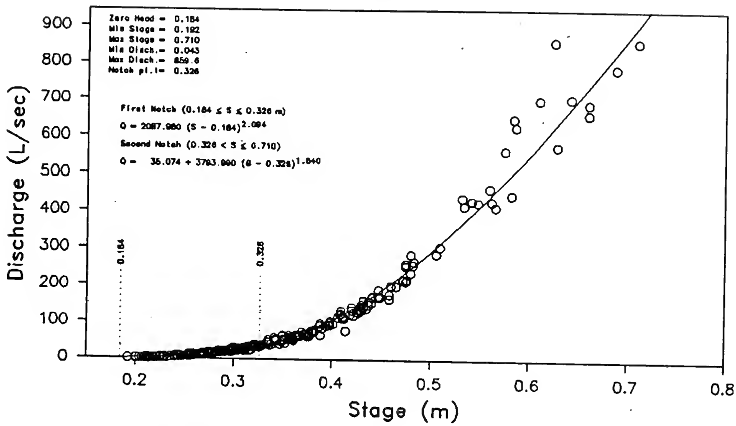


Figure 2

Discharge–Stage Calibration for HARP 5



Discharge–Stage Calibration for HARP 6

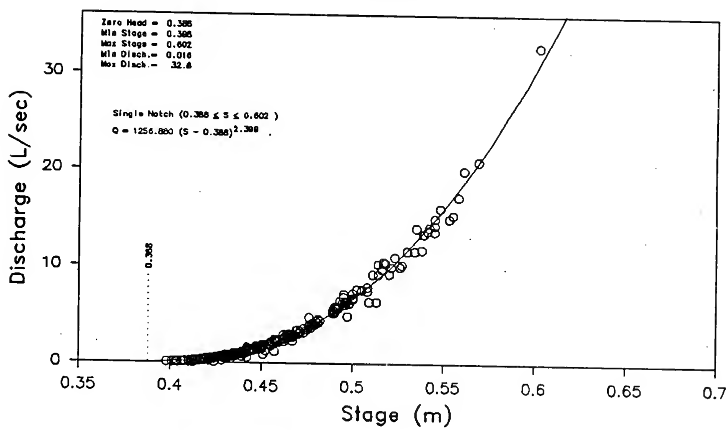
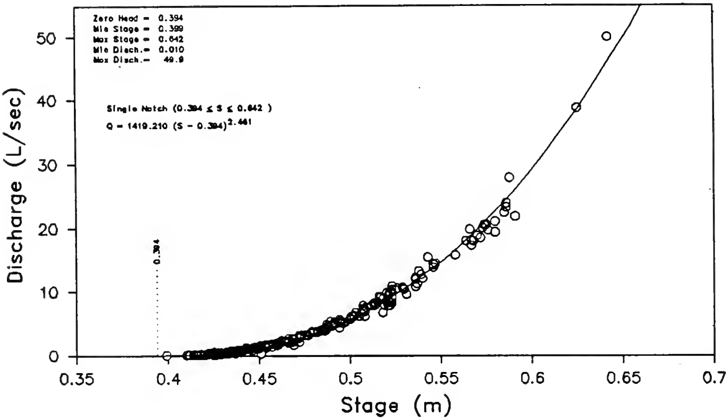


Figure 2

Discharge–Stage Calibration for HARP 6A



Discharge–Stage Calibration for HARP OUTFLOW

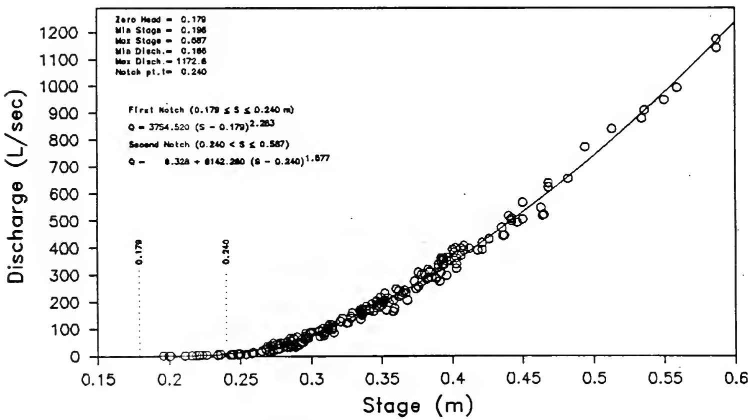


Figure 2

Discharge–Stage Calibration for
HENEY OUTFLOW

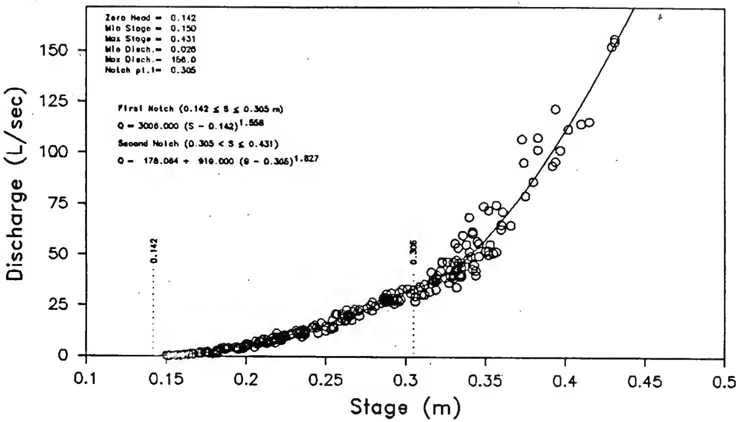
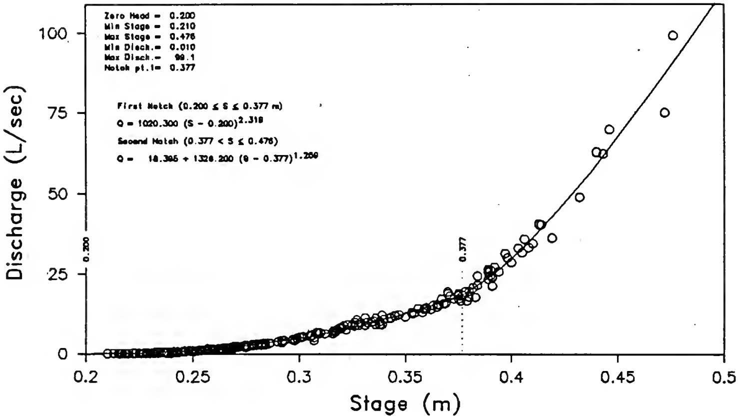


Figure 2

Discharge–Stage Calibration for
PLASTIC 1



Discharge–Stage Calibration for
PLASTIC 1_08

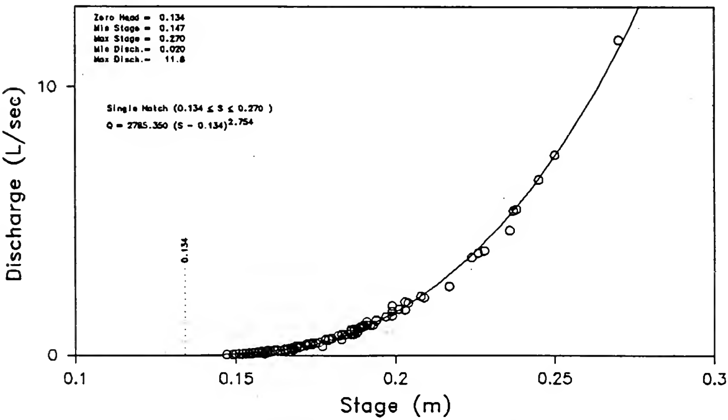
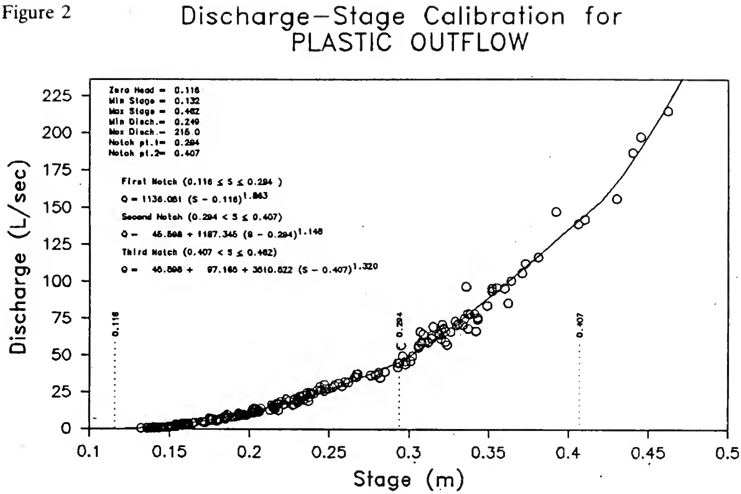


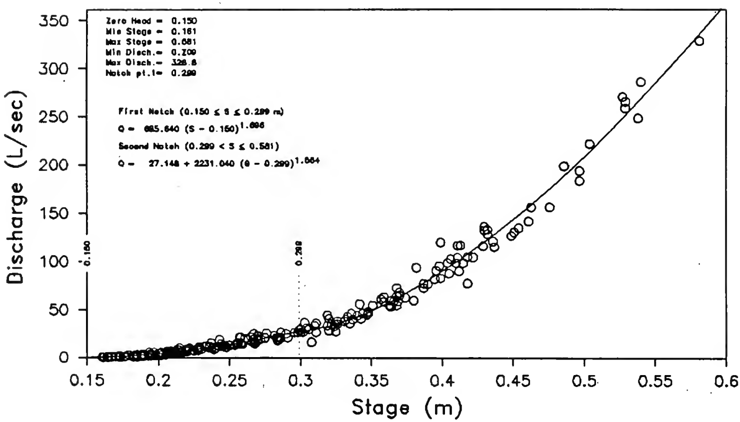
Figure 2



Discharge–Stage Calibration for
PLASTIC OUTFLOW
Zero Head = 0.116
Min Stage = 0.132
Max Stage = 0.462
Min Disch.= 0.249
Max Disch.= 215.0
Notch pt.1= 0.294
Notch pt.2= 0.407
First Notch (0.116 ≤ S ≤ 0.294)
Q = 1136.081 (S − 0.116)^1.863
Second Notch (0.294 < S ≤ 0.407)
Q = 45.598 + 1187.345 (S − 0.294)^1.148
Third Notch (0.407 < S ≤ 0.462)
Q = 45.598 + 97.165 + 3610.822 (S − 0.407)^1.320
0.116
0.294
0.407
Discharge (L/sec)
Stage (m)
0
25
50
75
100
125
150
175
200
225
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5

Figure 2

Discharge–Stage Calibration for RED CHALK 1



Discharge–Stage Calibration for RED CHALK 2

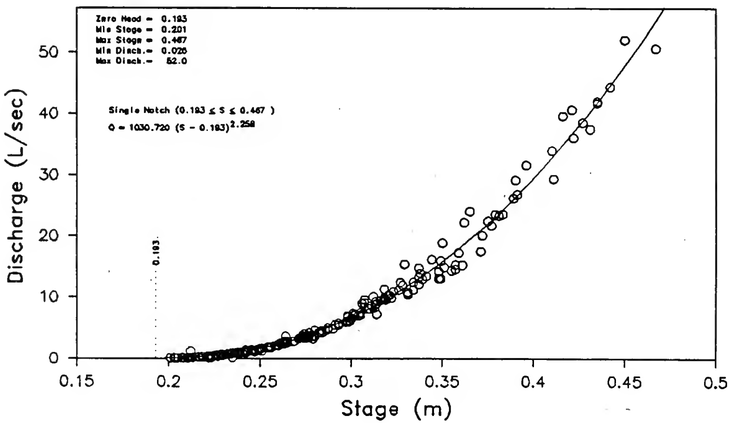
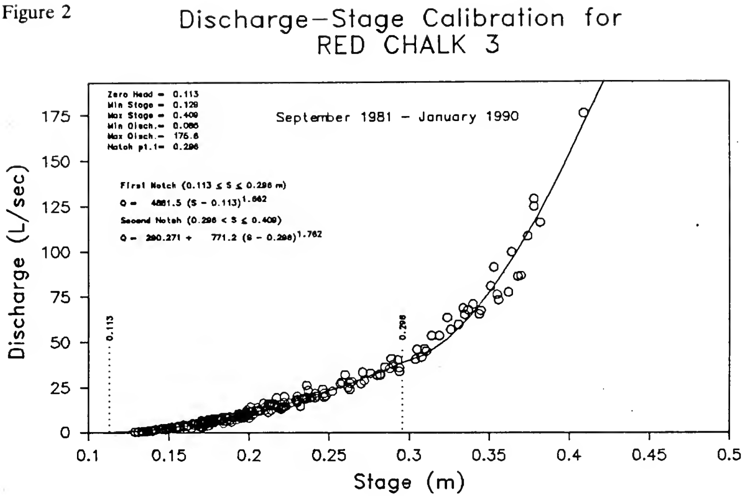


Figure 2


Discharge–Stage Calibration for
RED CHALK 3
Zero Head = 0.113
Min Stage = 0.128
Max Stage = 0.409
Min Disch.= 0.086
Max Disch.= 176.6
Notch pt.1= 0.298
September 1981 – January 1990
First Notch (0.113 ≤ S ≤ 0.298 m)
Q = 4881.5 (S – 0.113)^1.662
Second Notch (0.298 < S ≤ 0.409)
Q = 290.271 + 771.2 (S – 0.298)^1.762
0.113
0.298
Discharge (L/sec)
Stage (m)
0
25
50
75
100
125
150
175
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5

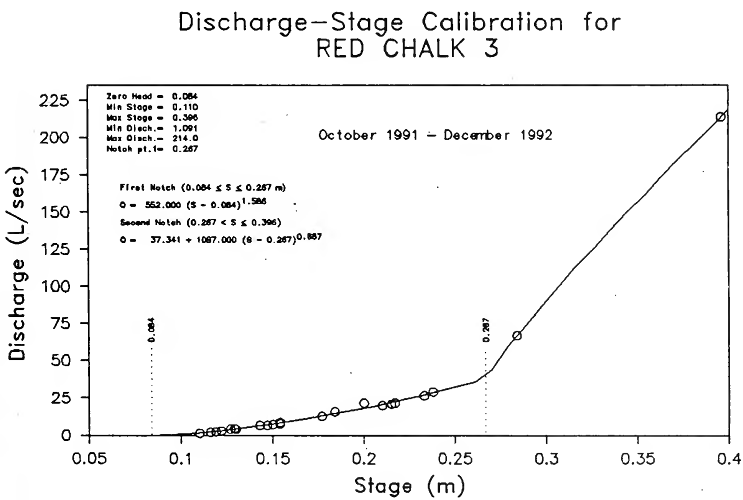

Discharge–Stage Calibration for
RED CHALK 3
Zero Head = 0.084
Min Stage = 0.110
Max Stage = 0.396
Min Disch.= 1.091
Max Disch.= 214.0
Notch pt.1= 0.267
October 1991 – December 1992
First Notch (0.084 ≤ S ≤ 0.267 m)
Q = 552.000 (S – 0.084)^1.586
Second Notch (0.267 < S ≤ 0.396)
Q = 37.341 + 1067.000 (S – 0.267)^0.887
0.084
0.267
Discharge (L/sec)
Stage (m)
0
25
50
75
100
125
150
175
200
225
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4

Figure 2

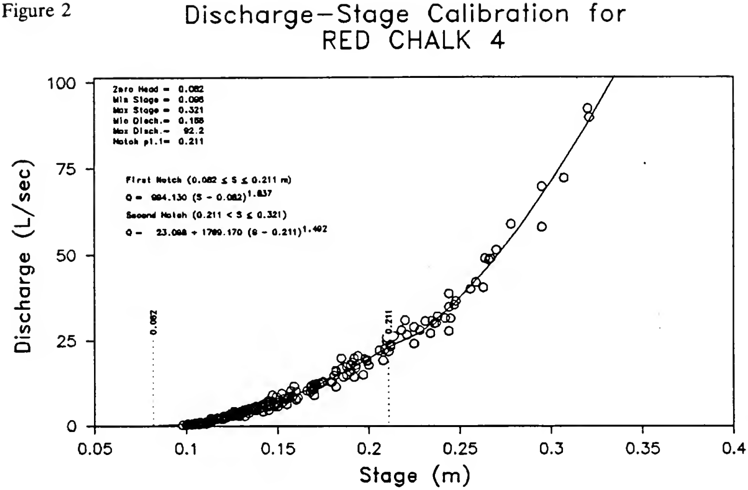
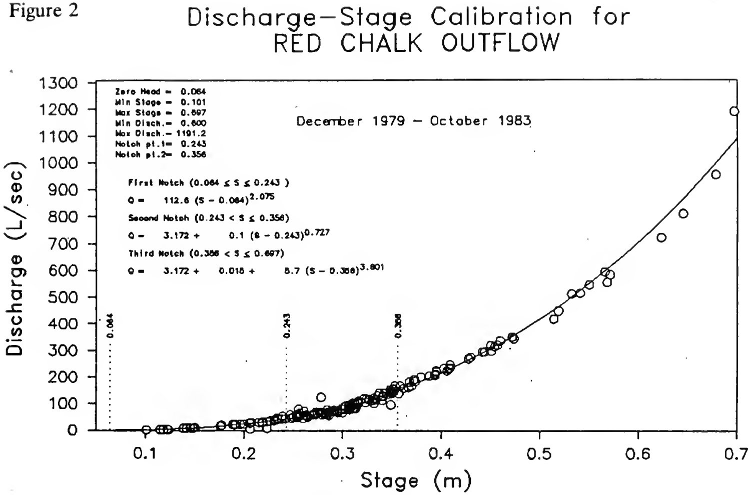
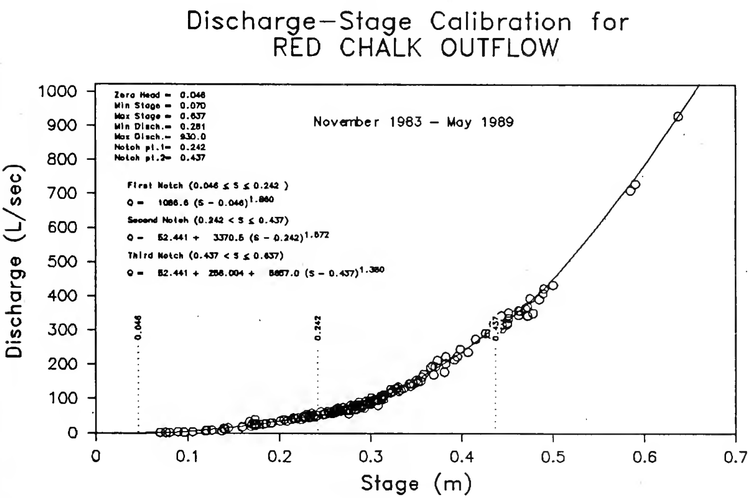

Discharge–Stage Calibration for
RED CHALK 4
Zero Head = 0.082
Min Stage = 0.098
Max Stage = 0.321
Min Disch.= 0.155
Max Disch.= 92.2
Notch pt.1= 0.211
First Notch (0.082 ≤ S ≤ 0.211 m)
Q = 994.130 (S - 0.082)^1.837
Second Notch (0.211 < S ≤ 0.321)
Q = 23.098 + 1789.170 (S - 0.211)^1.492
0.082
0.211
Discharge (L/sec)
Stage (m)
0
25
50
75
100
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4

Figure 2



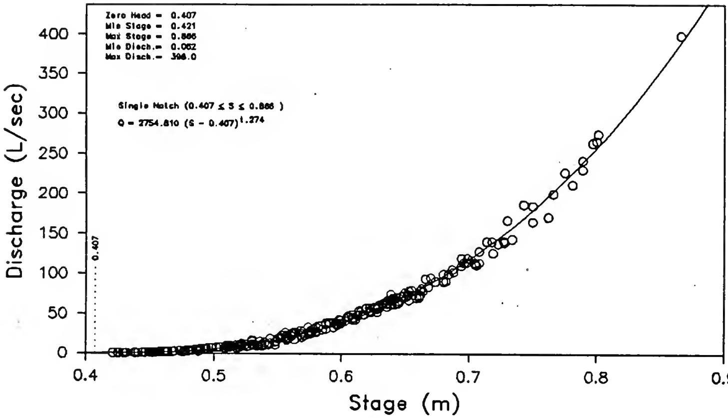
Discharge–Stage Calibration for
RED CHALK OUTFLOW
Zero Head = 0.064
Min Stage = 0.101
Max Stage = 0.697
Min Disch.= 0.600
Max Disch.= 1191.2
Notch pt.1= 0.243
Notch pt.2= 0.356
December 1979 – October 1983
First Notch (0.064 ≤ S ≤ 0.243)
Q = 112.6 (S – 0.064)^2.075
Second Notch (0.243 < S ≤ 0.356)
Q = 3.172 + 0.1 (S – 0.243)^0.727
Third Notch (0.356 < S ≤ 0.697)
Q = 3.172 + 0.018 + 5.7 (S – 0.356)^3.801
0.064
0.243
0.356
Discharge (L/sec)
Stage (m)



Discharge–Stage Calibration for
RED CHALK OUTFLOW
Zero Head = 0.046
Min Stage = 0.070
Max Stage = 0.637
Min Disch.= 0.281
Max Disch.= 930.0
Notch pt.1= 0.242
Notch pt.2= 0.437
November 1983 – May 1989
First Notch (0.046 ≤ S ≤ 0.242)
Q = 1086.6 (S – 0.046)^1.860
Second Notch (0.242 < S ≤ 0.437)
Q = 52.441 + 3370.5 (S – 0.242)^1.672
Third Notch (0.437 < S ≤ 0.637)
Q = 52.441 + 258.004 + 5667.0 (S – 0.437)^1.380
0.046
0.242
0.437
Discharge (L/sec)
Stage (m)

Figure 2

Discharge–Stage Calibration for TWELVE MILE SOUTH



Discharge–Stage Calibration for TWELVE MILE NORTH

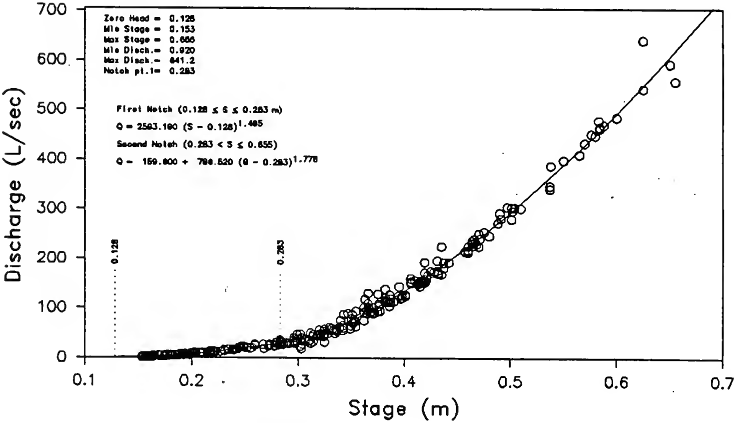
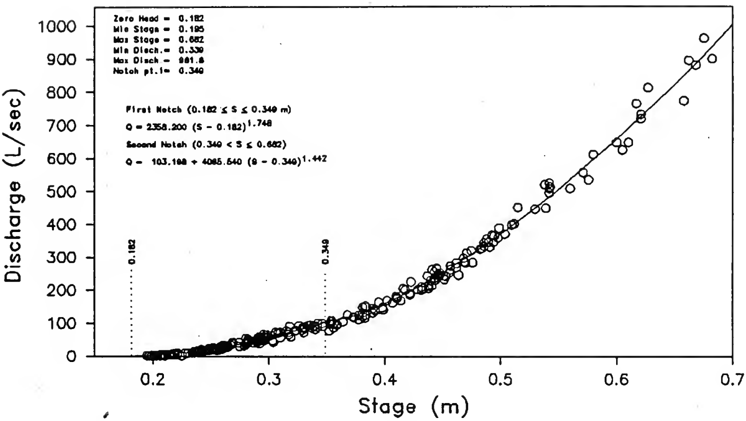


Figure 2

Discharge–Stage Calibration for BEECH 1



Discharge–Stage Calibration for PAINT LAKE 1

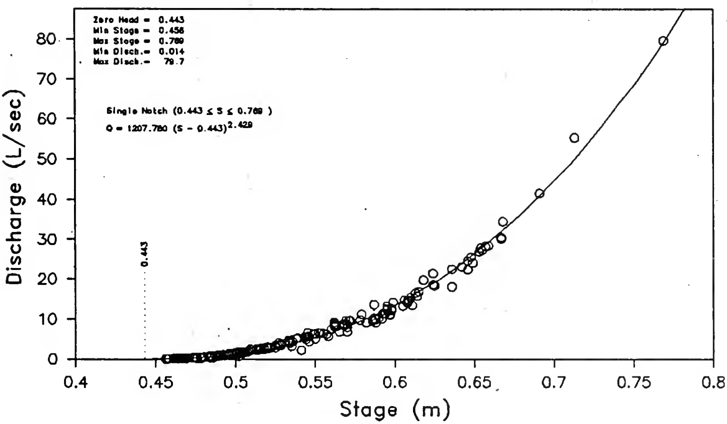


Figure 3 Plot of stage-discharge relationship for a multi-notch gauging structure (with equations for each notch), illustrating the sequential summation of the terms in the expressions.

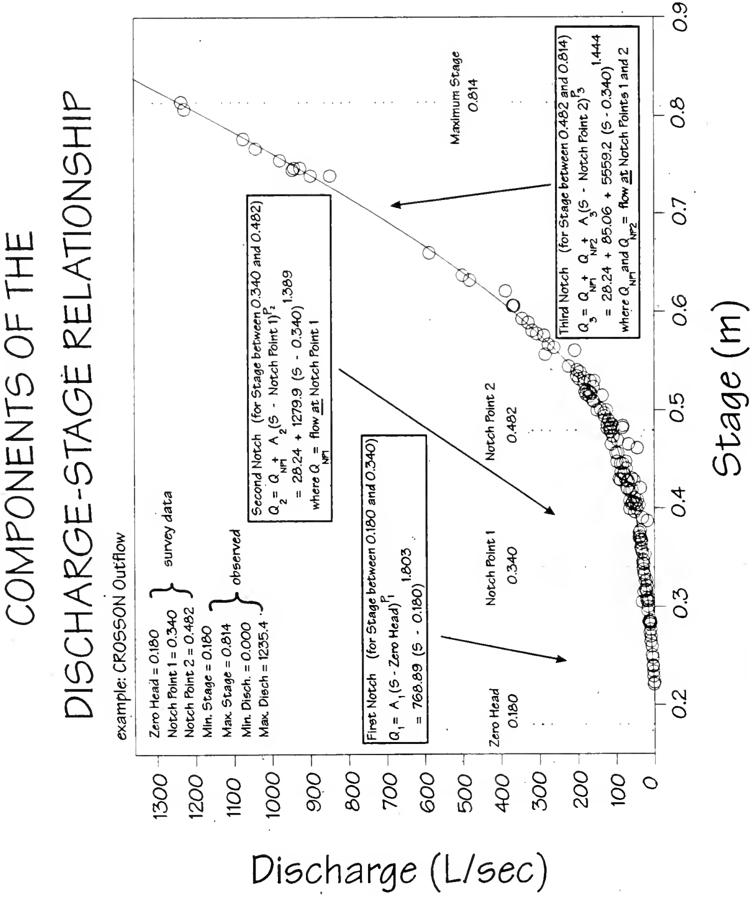


Figure 4

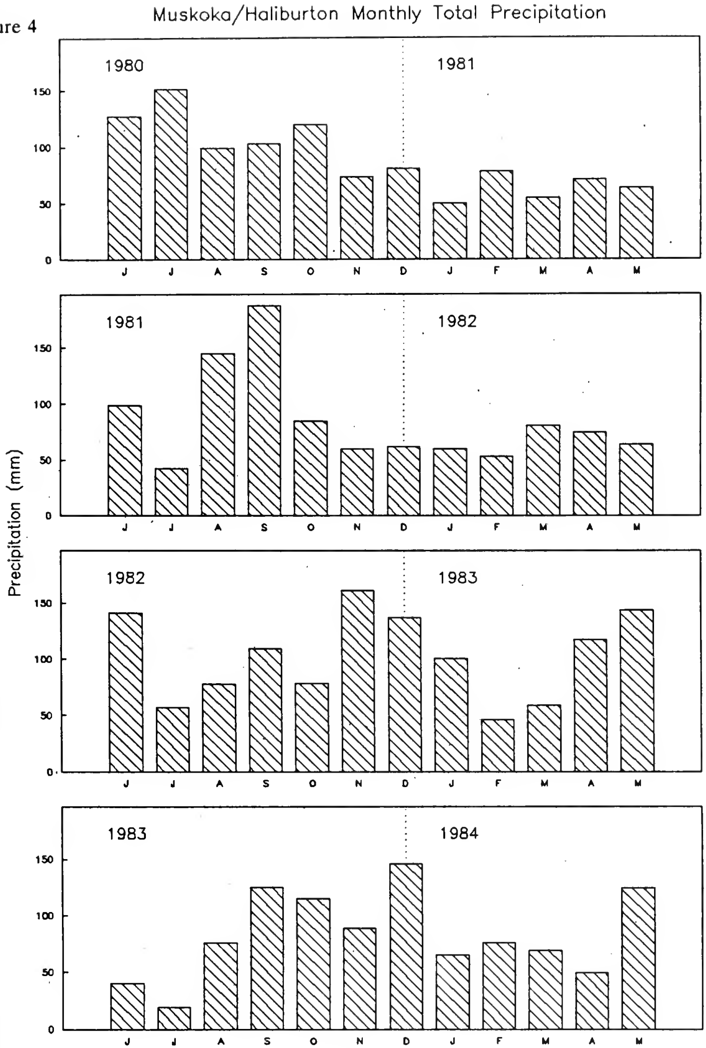

Muskoka/Haliburton Monthly Total Precipitation
Precipitation (mm)
1980
1981
1982
1983
1984
0
50
100
150
J J A S O N D J F M A M

Figure 4

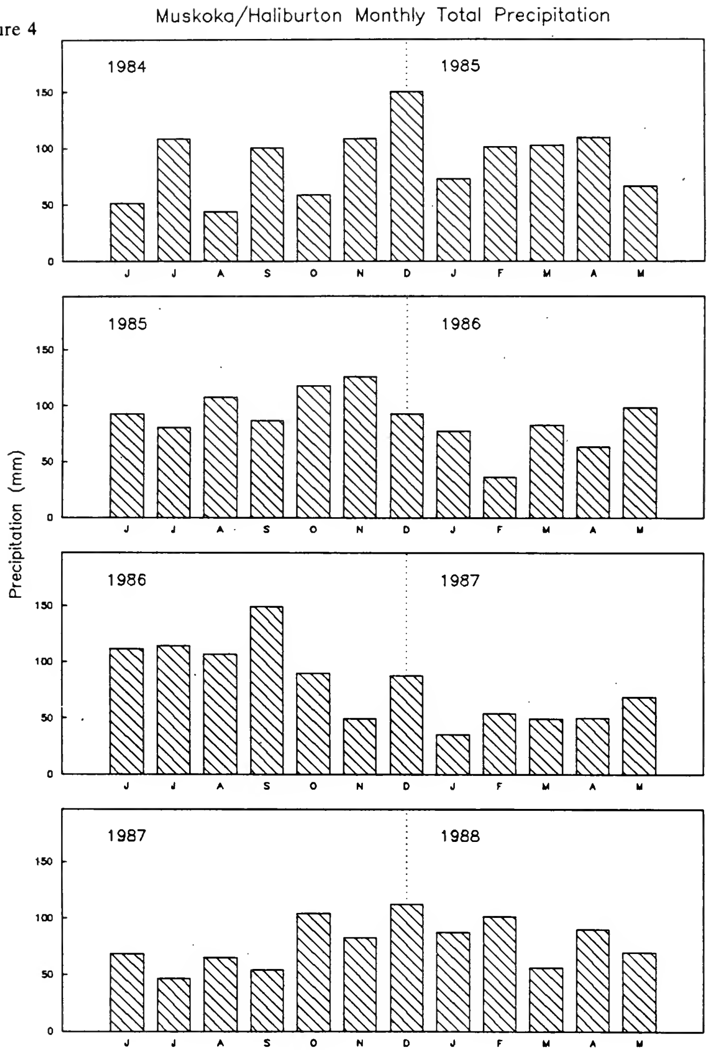

Muskoka/Haliburton Monthly Total Precipitation
Precipitation (mm)
1984
1985
1985
1986
1986
1987
1987
1988
0
50
100
150
J J A S O N D J F M A M

Figure 4

Muskoka/Haliburton Monthly Total Precipitation

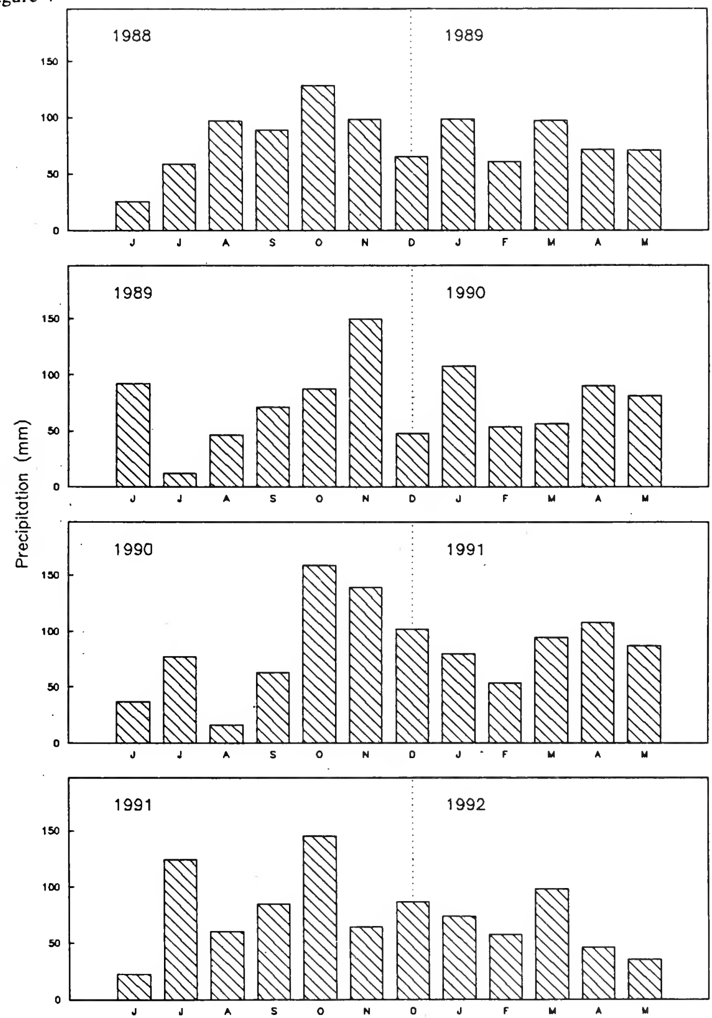
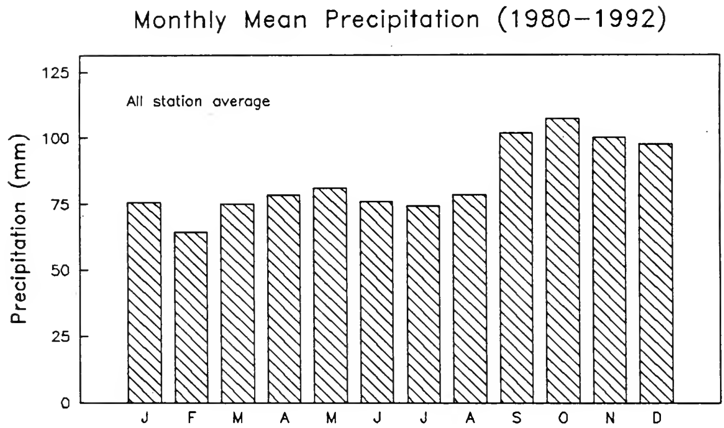


Figure 5 Distribution of total precipitation (mm) all stations, 1980-1992.



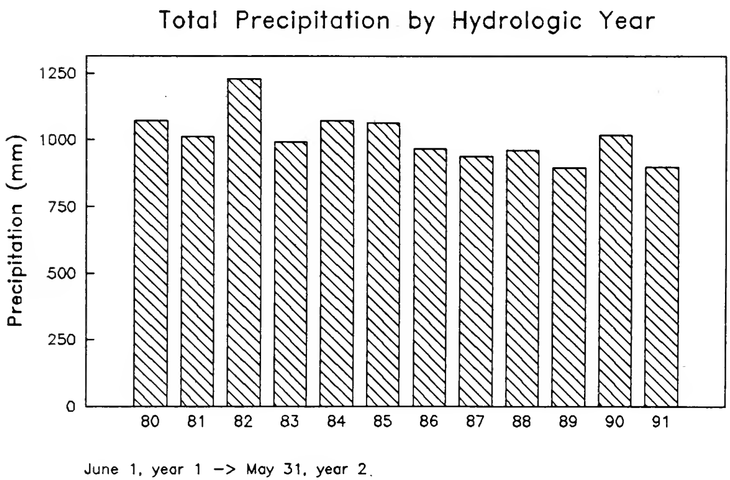


Figure 6 Mean daily discharge (L/sec) for 26 inlet streams, 1980-1992.

Blue Chalk 1	(1980-1984)
	(1984-1988)
	(1988-1992)
Chub 1	(1980-1984)
	(1984-1988)
	(1988-1992)
Chub 2	(1980-1984)
	(1984-1988)
	(1988-1992)
Crosson 1	(1980-1984)
	(1984-1988)
	(1988-1992)
Dickie 5	(1980-1984)
	(1984-1988)
	(1988-1992)
Dickie 6	(1980-1984)
	(1984-1988)
	(1988-1992)
Dickie 8	(1980-1984)
	(1984-1988)
	(1988-1992)
Dickie 10	(1980-1984)
	(1984-1988)
	(1988-1992)
Dickie 11	(1980-1984)
	(1984-1988)
	(1988-1992)
Harp 3	(1980-1984)
	(1984-1988)
	(1988-1992)
Harp 3a	(1980-1984)
	(1984-1988)
	(1988-1992)
Harp 4	(1980-1984)
	(1984-1988)
	(1988-1992)
Harp 4_21	(1988-1992)
Harp 5	(1980-1984)
	(1984-1988)
	(1988-1992)
Harp 6	(1980-1984)
	(1984-1988)
	(1988-1992)

Figure 6 (cont'd.) ...

Harp 6a	(1980-1984)
	(1994-1988)
	(1988-1992)
Plastic 1	(1980-1984)
	(1984-1988)
	(1988-1992)
Plastic 1_08	(1987-1988)
	(1988-1992)
Red Chalk 1	(1980-1984)
	(1984-1988)
	(1988-1992)
Red Chalk 2	(1980-1984)
	(1984-1988)
	(1988-1992)
Red Chalk 3	(1980-1984)
	(1984-1988)
	(1988-1992)
Red Chalk 4	(1980-1984)
	(1984-1988)
	(1988-1992)
Twelve Mile North	(1980-1984)
	(1984-1988)
	(1988-1992)
Twelve Mile South	(1980-1984)
	(1984-1988)
	(1988-1992)
Beech 1	(1980-1984)
	(1984-1988)
	(1988-1992)
Paint 1	(1980-1984)
	(1984-1988)
	(1988-1992)

Figure 6

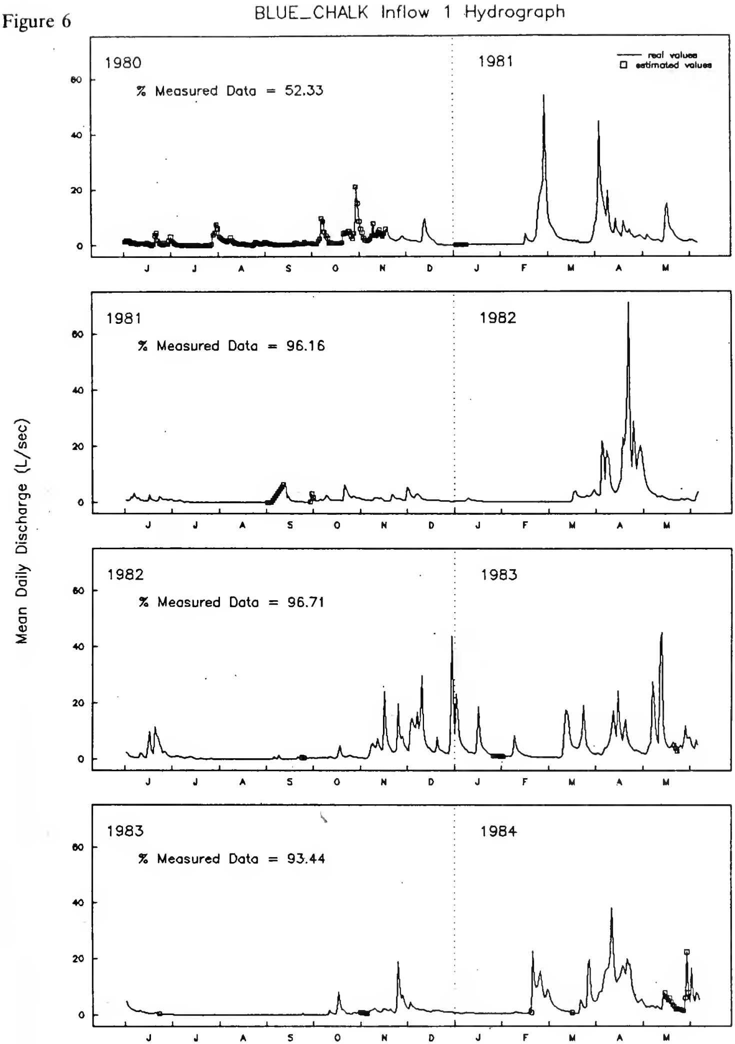

BLUE_CHALK Inflow 1 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 52.33
1981
1982
% Measured Data = 96.16
1982
1983
% Measured Data = 96.71
1983
1984
% Measured Data = 93.44
0
20
40
60
J J A S O N D J F M A M

Figure 6

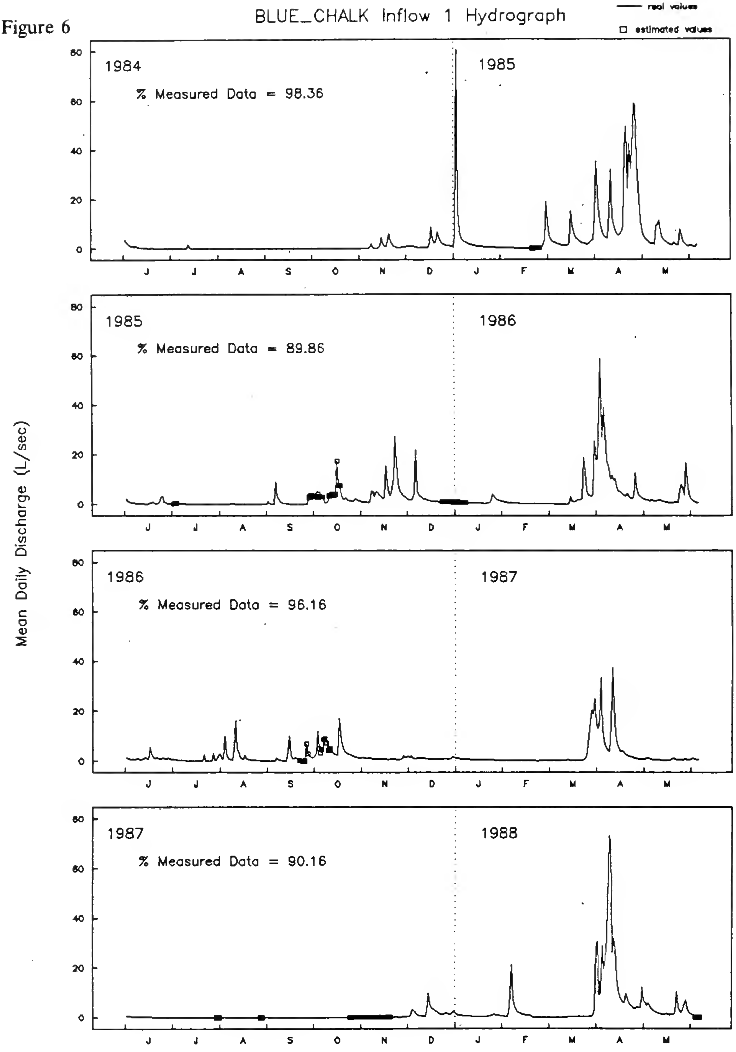

BLUE_CHALK Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 98.36
1985
1986
% Measured Data = 89.86
1986
1987
% Measured Data = 96.16
1987
1988
% Measured Data = 90.16
0
20
40
60
80
J J A S O N D J F M A M

Figure 6

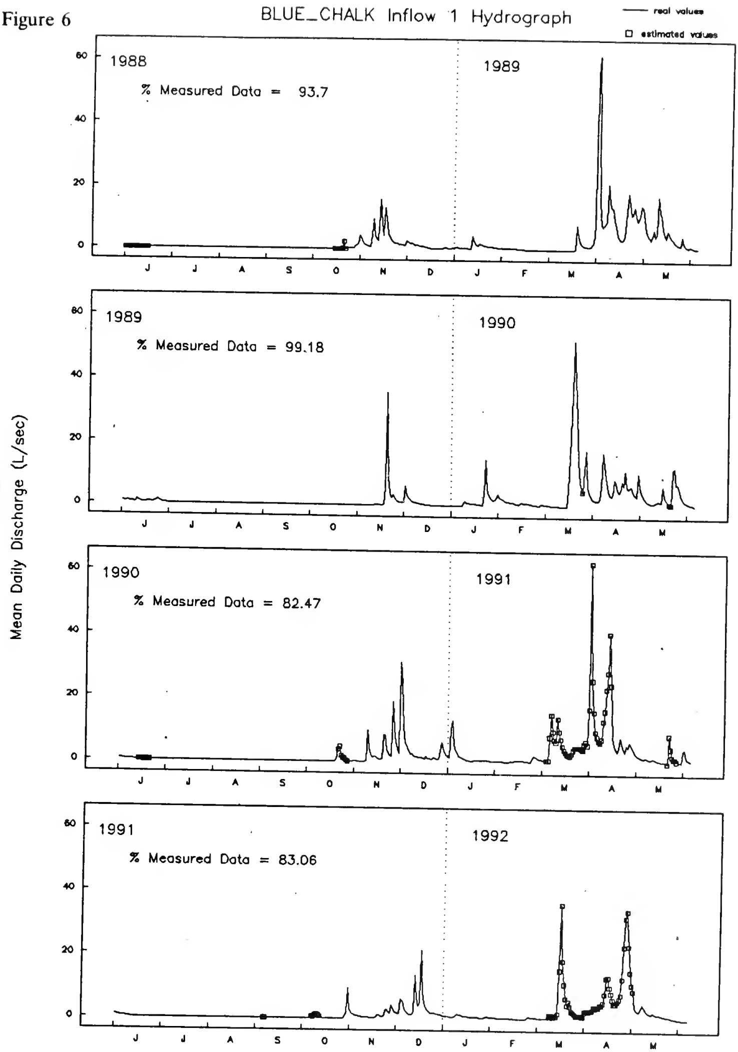

BLUE_CHALK Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 93.7
1989
1990
% Measured Data = 99.18
1990
1991
% Measured Data = 82.47
1991
1992
% Measured Data = 83.06
0
20
40
60
J J A S O N D J F M A M

Figure 6

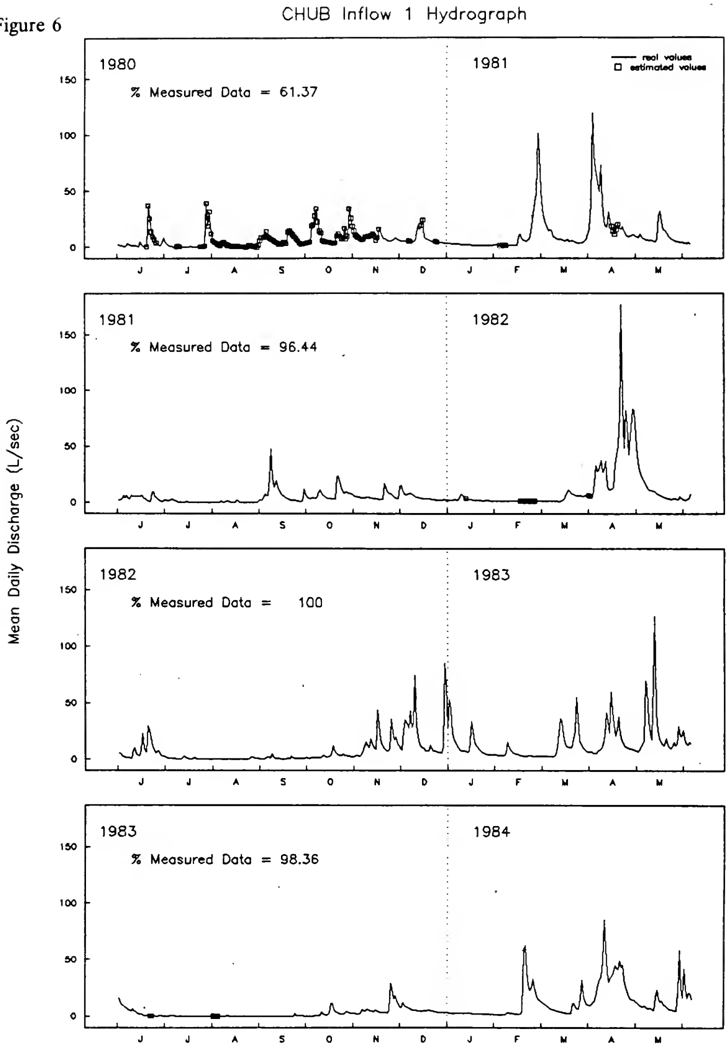

CHUB Inflow 1 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 61.37
1981
1982
% Measured Data = 96.44
1982
1983
% Measured Data = 100
1983
1984
% Measured Data = 98.36
0
50
100
150
J J A S O N D J F M A M

Figure 6

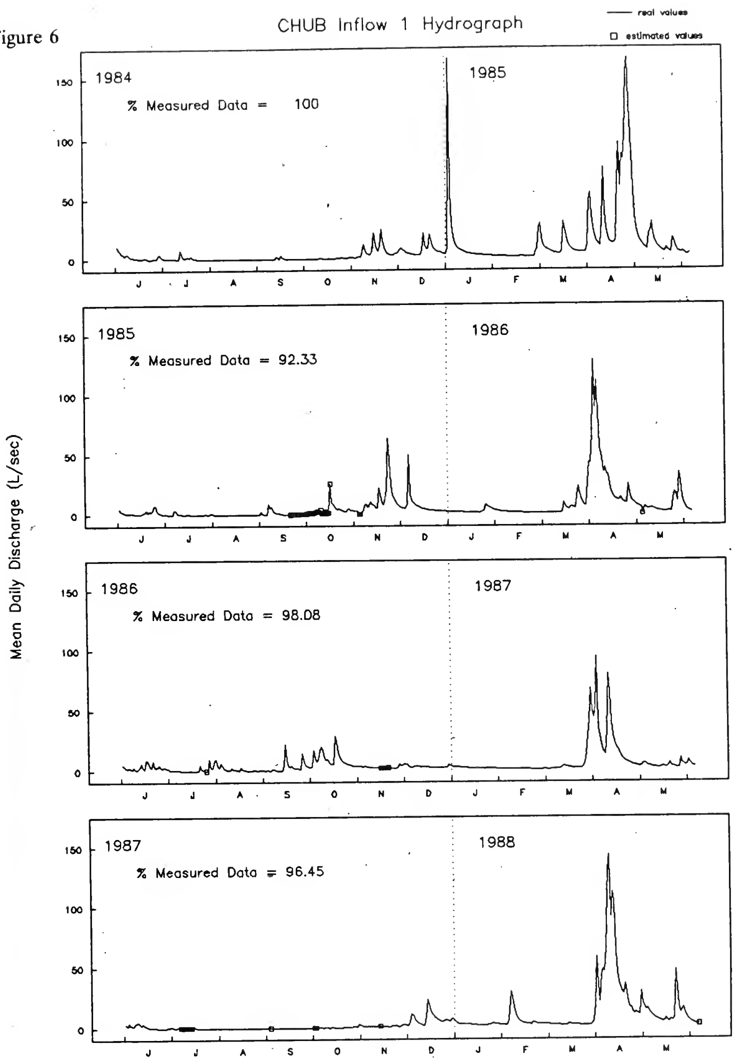

CHUB Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 92.33
1986
1987
% Measured Data = 98.08
1987
1988
% Measured Data = 96.45
0
50
100
150
J J A S O N D J F M A M

Figure 6

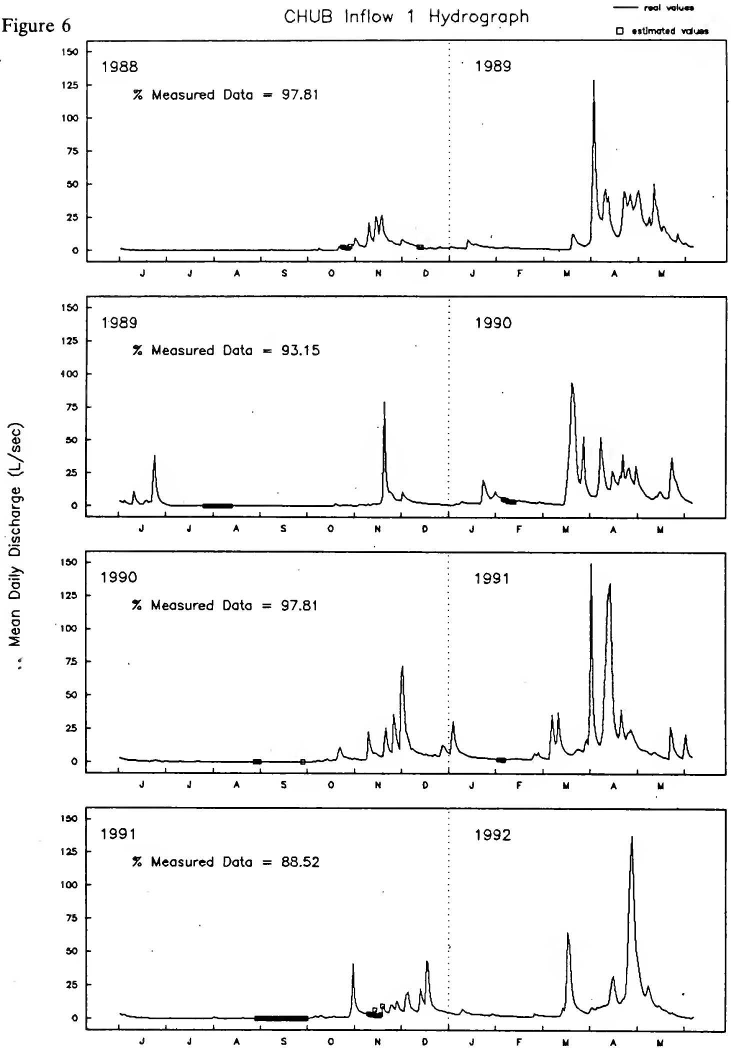

CHUB Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 97.81
1989
1990
% Measured Data = 93.15
1990
1991
% Measured Data = 97.81
1991
1992
% Measured Data = 88.52
150
125
100
75
50
25
0
J J A S O N D J F M A M

Figure 6

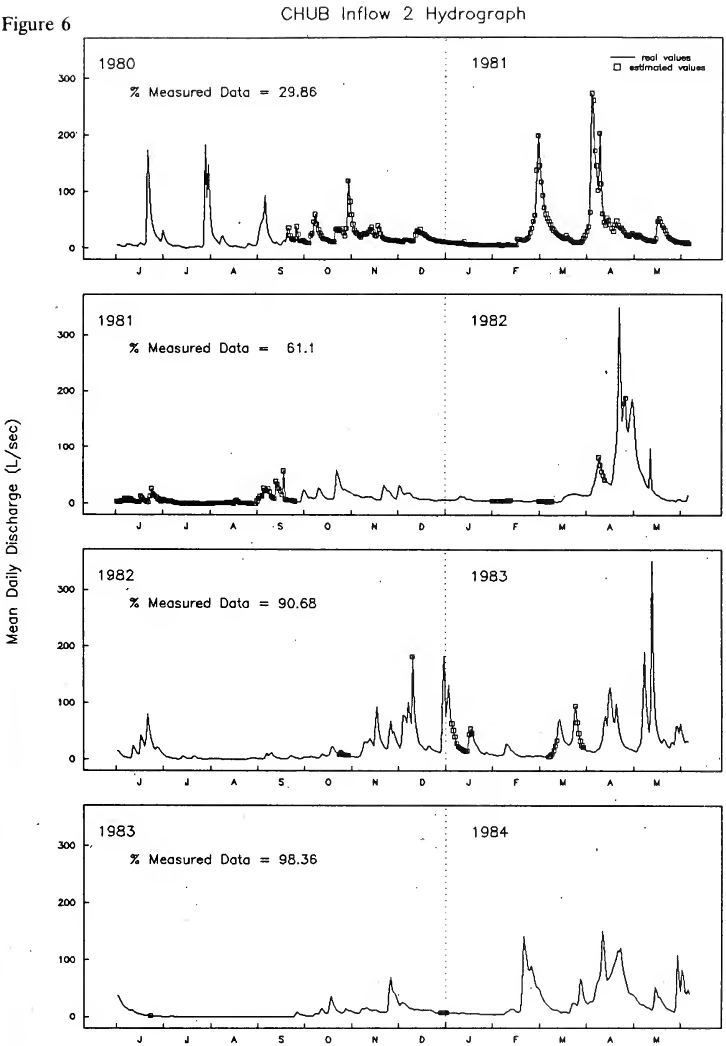
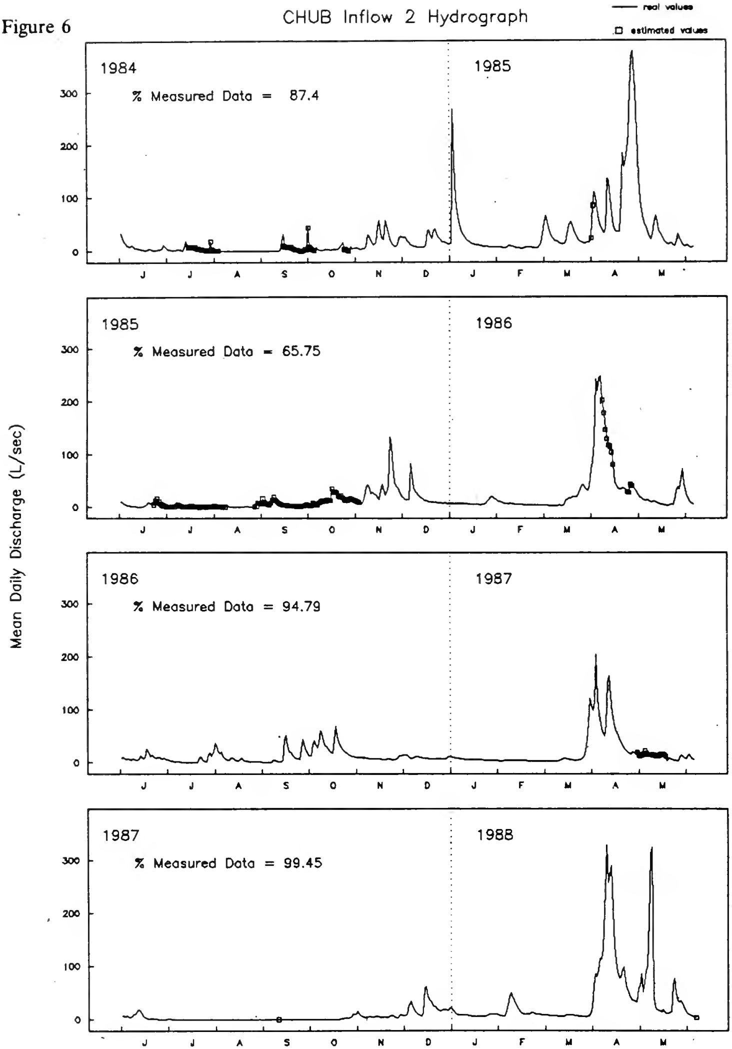

CHUB Inflow 2 Hydrograph
real values
estimated values
1980
1981
% Measured Data = 29.86
1981
1982
% Measured Data = 61.1
1982
1983
% Measured Data = 90.68
1983
1984
% Measured Data = 98.36
Mean Daily Discharge (L/sec)
0
100
200
300
J J A S O N D J F M A M

Figure 6



CHUB Inflow 2 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 87.4
1985
1986
% Measured Data = 65.75
1986
1987
% Measured Data = 94.79
1987
1988
% Measured Data = 99.45
0
100
200
300
J J A S O N D J F M A M

Figure 6

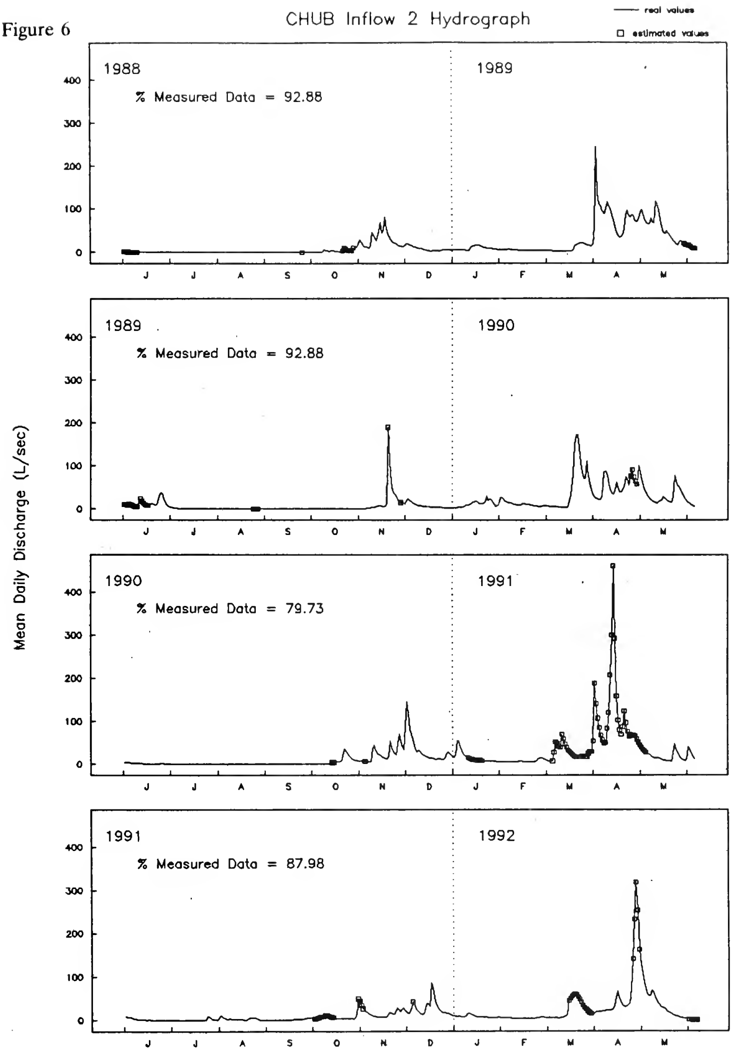

CHUB Inflow 2 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 92.88
1989
1990
% Measured Data = 92.88
1990
1991
% Measured Data = 79.73
1991
1992
% Measured Data = 87.98
0
100
200
300
400
J J A S O N D J F M A M

Figure 6

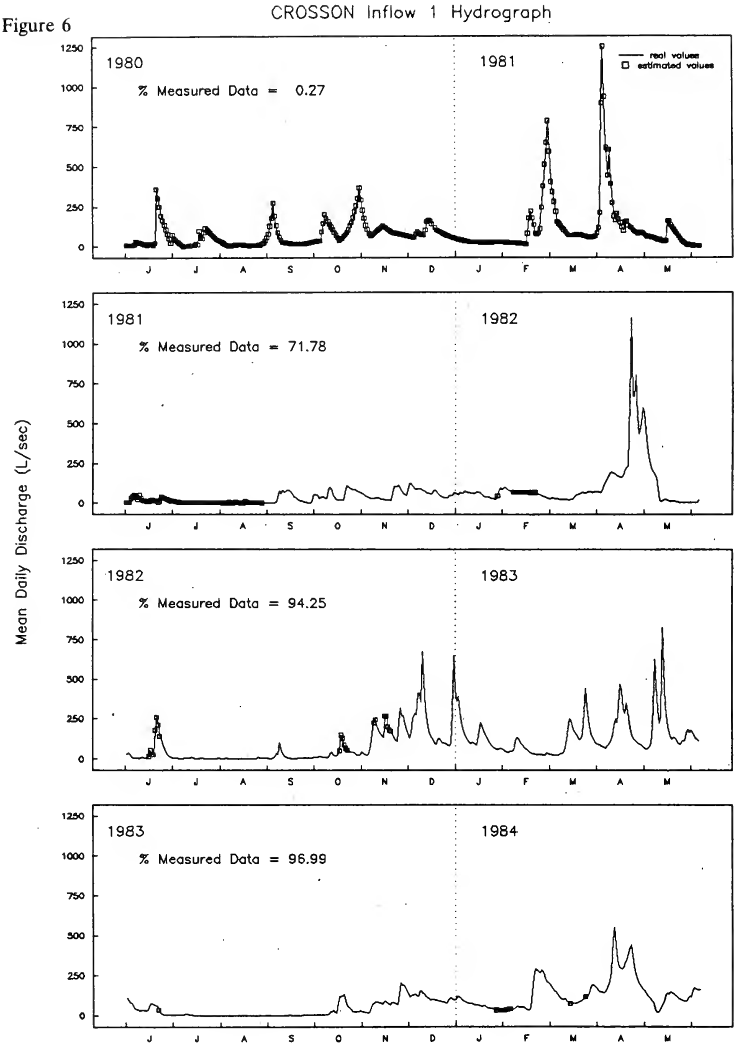

CROSSON Inflow 1 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 0.27
1981
1982
% Measured Data = 71.78
1982
1983
% Measured Data = 94.25
1983
1984
% Measured Data = 96.99
1250
1000
750
500
250
0
J J A S O N D J F M A M

Figure 6

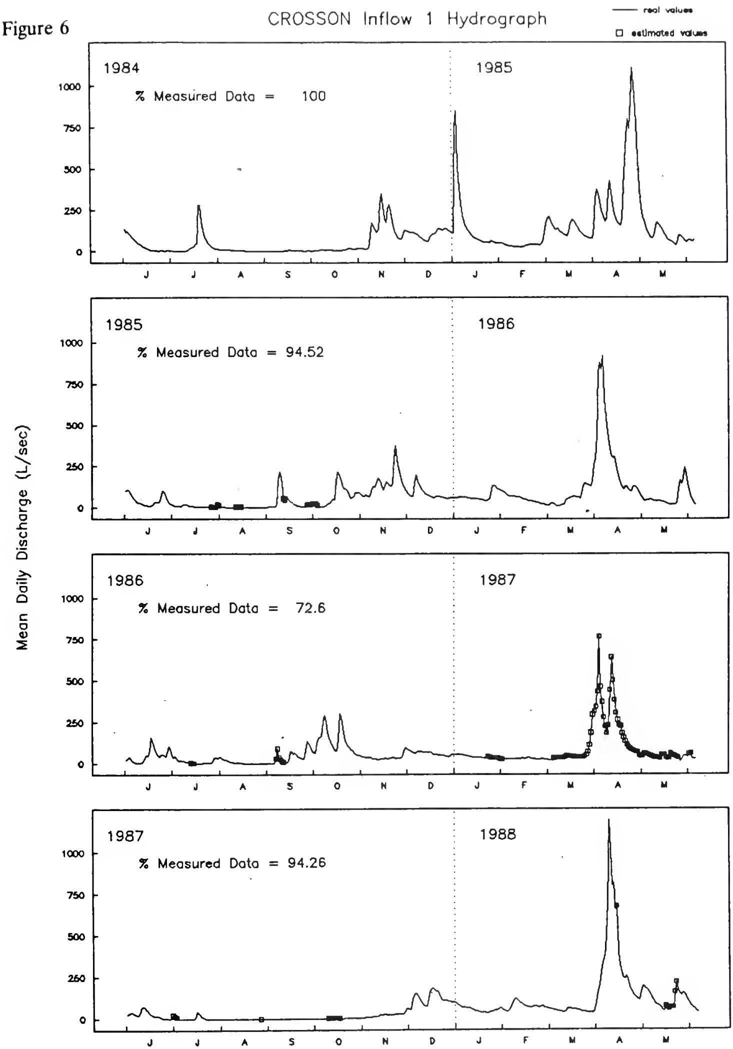

CROSSON Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 94.52
1986
1987
% Measured Data = 72.6
1987
1988
% Measured Data = 94.26
0
250
500
750
1000
J J A S O N D J F M A M

Figure 6

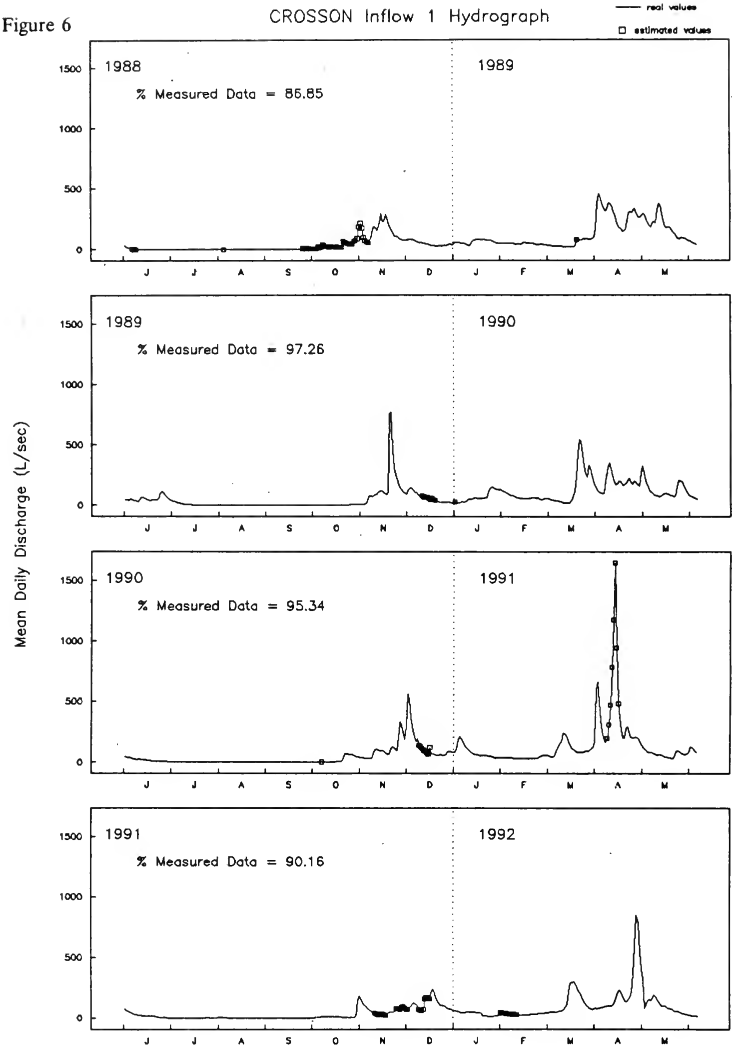

CROSSON Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 86.85
1989
1990
% Measured Data = 97.26
1990
1991
% Measured Data = 95.34
1991
1992
% Measured Data = 90.16
1500
1000
500
0
J J A S O N D J F M A M

Figure 6

DICKIE Inflow 5 Hydrograph

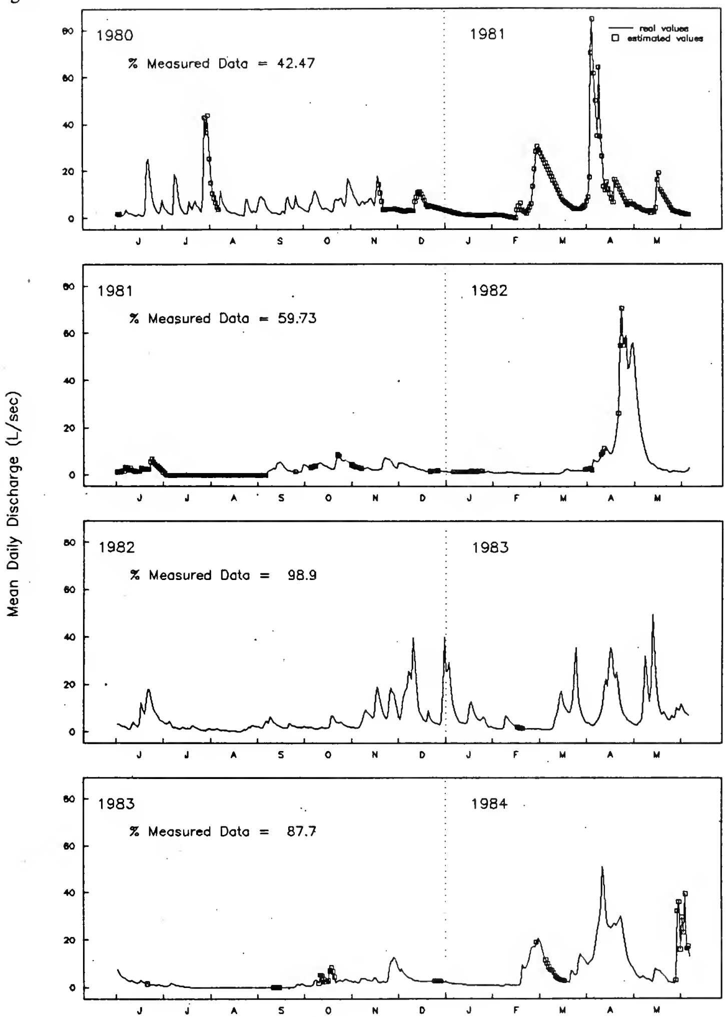


Figure 6

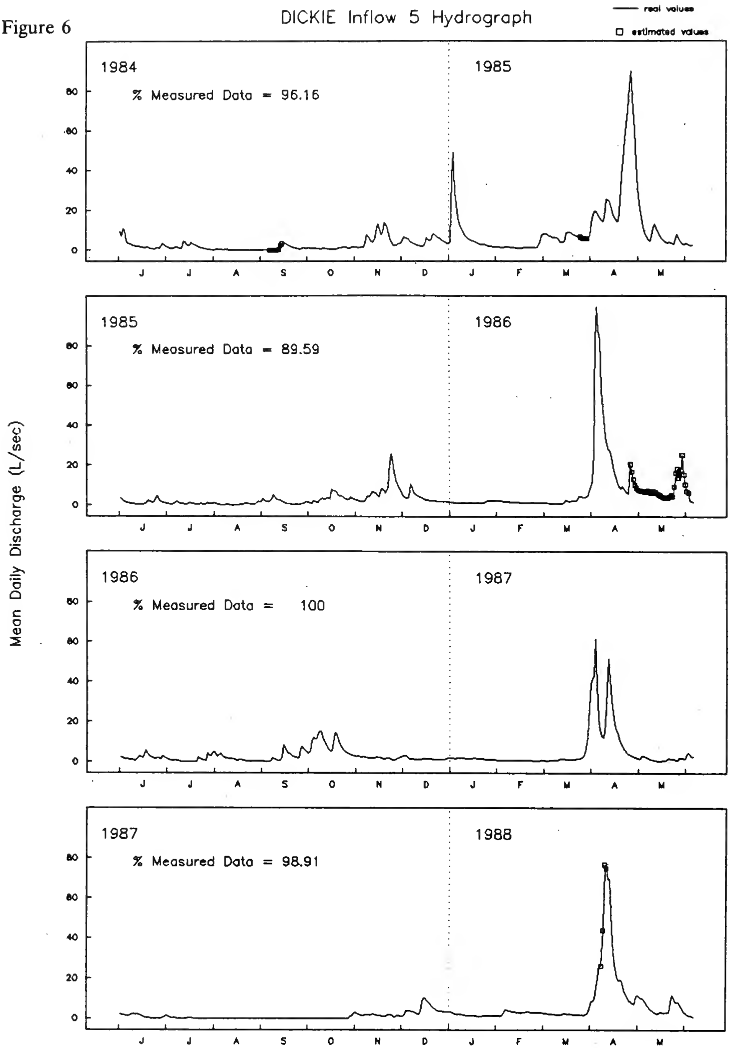

DICKIE Inflow 5 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 96.16
1985
1986
% Measured Data = 89.59
1986
1987
% Measured Data = 100
1987
1988
% Measured Data = 98.91
0
20
40
60
80
J J A S O N D J F M A M

Figure 6

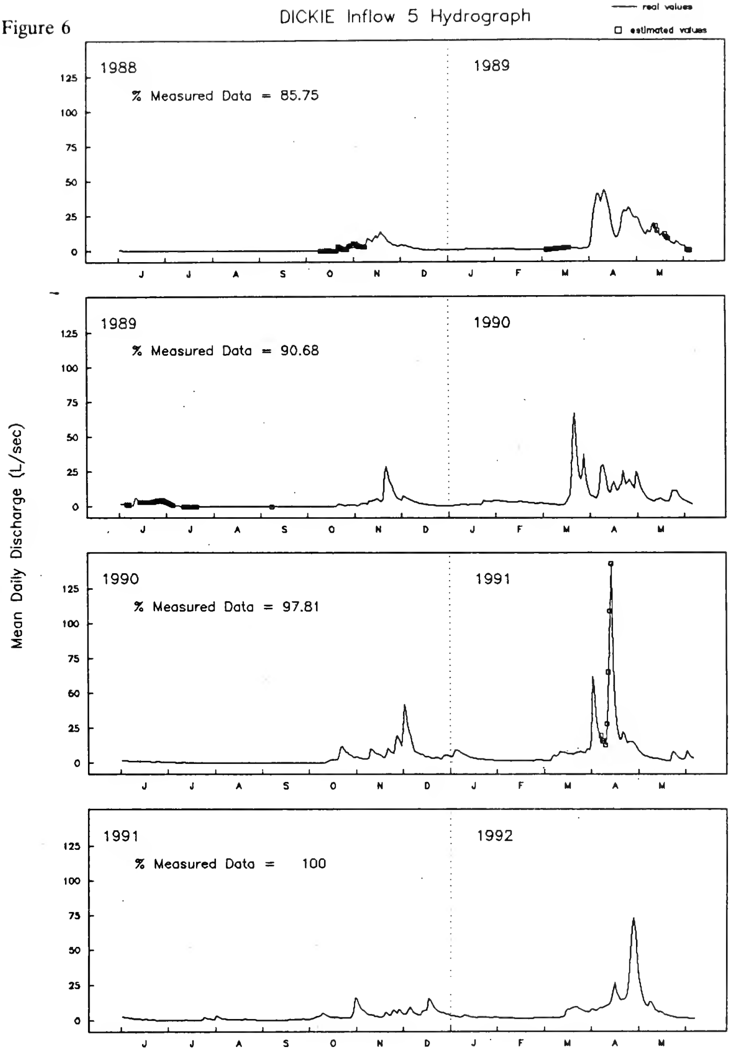

DICKIE Inflow 5 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 85.75
1989
1990
% Measured Data = 90.68
1990
1991
% Measured Data = 97.81
1991
1992
% Measured Data = 100
125
100
75
50
25
0
J J A S O N D J F M A M

Figure 6

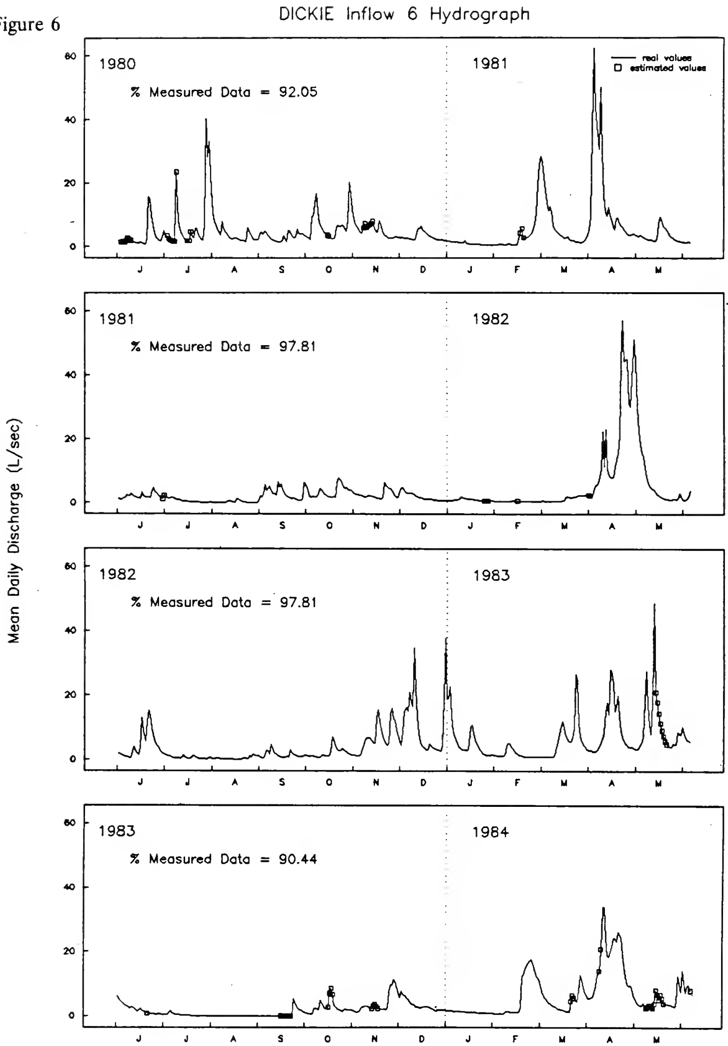

DICKIE Inflow 6 Hydrograph
Mean Daily Discharge (L/sec)
1980
1981
% Measured Data = 92.05
real values
estimated values
1981
1982
% Measured Data = 97.81
1982
1983
% Measured Data = 97.81
1983
1984
% Measured Data = 90.44
0
20
40
60
J
J
A
S
O
N
D
J
F
M
A
M

Figure 6

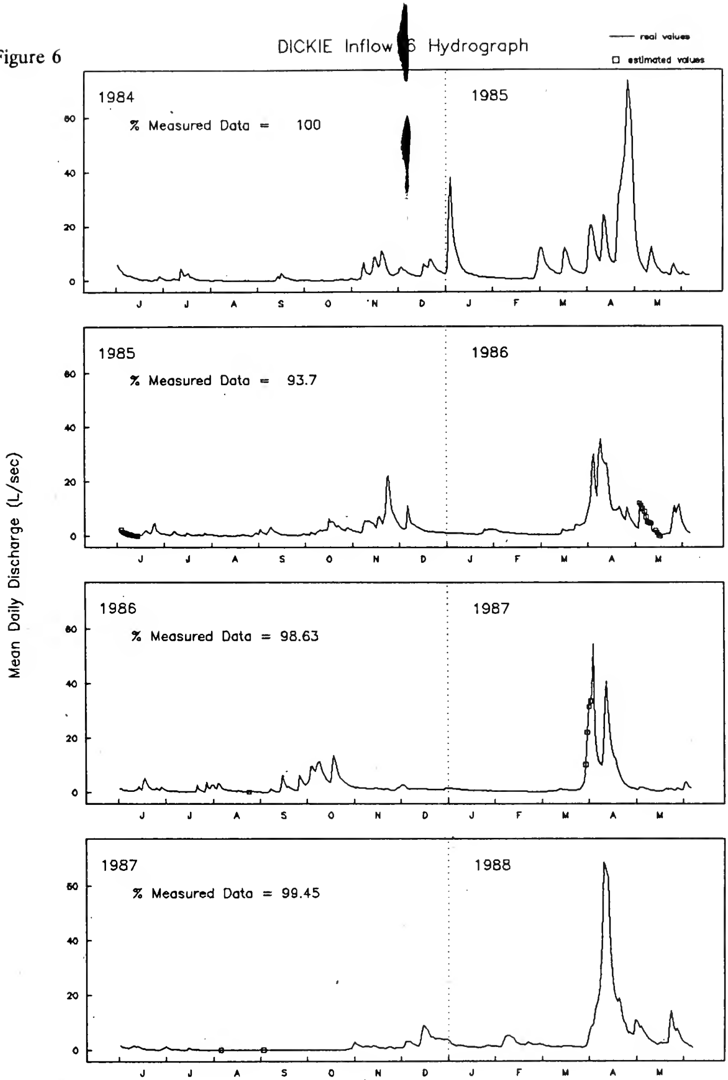

DICKIE Inflow 6 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 93.7
1986
1987
% Measured Data = 98.63
1987
1988
% Measured Data = 99.45
0
20
40
60
J J A S O N D J F M A M

Figure 6

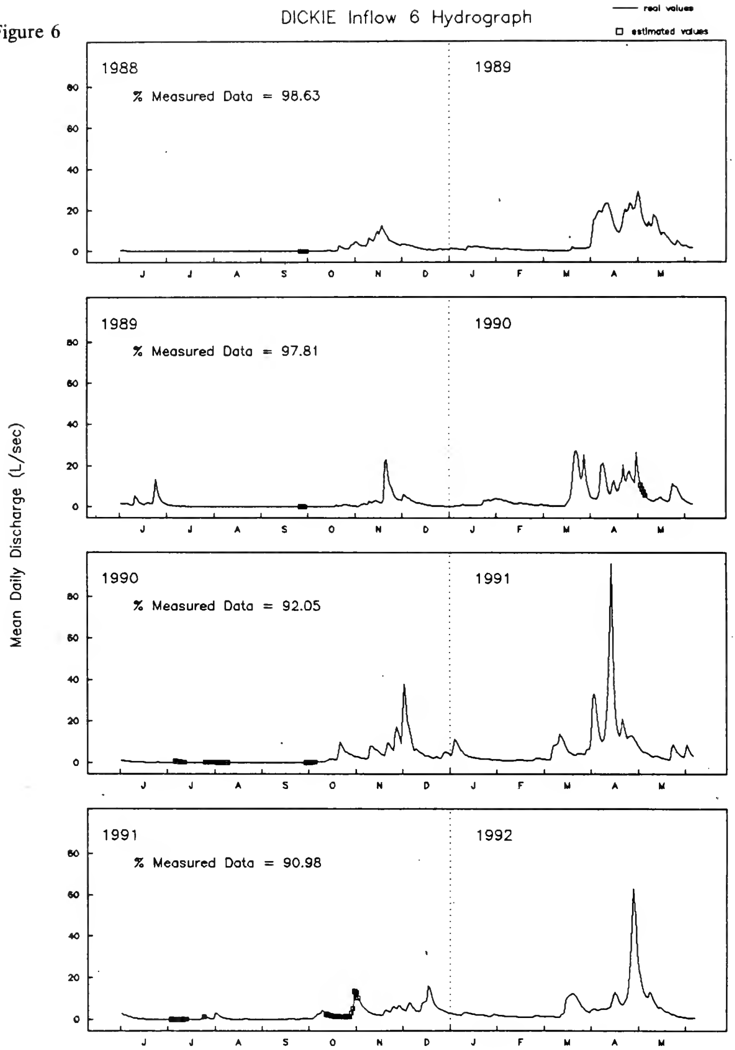
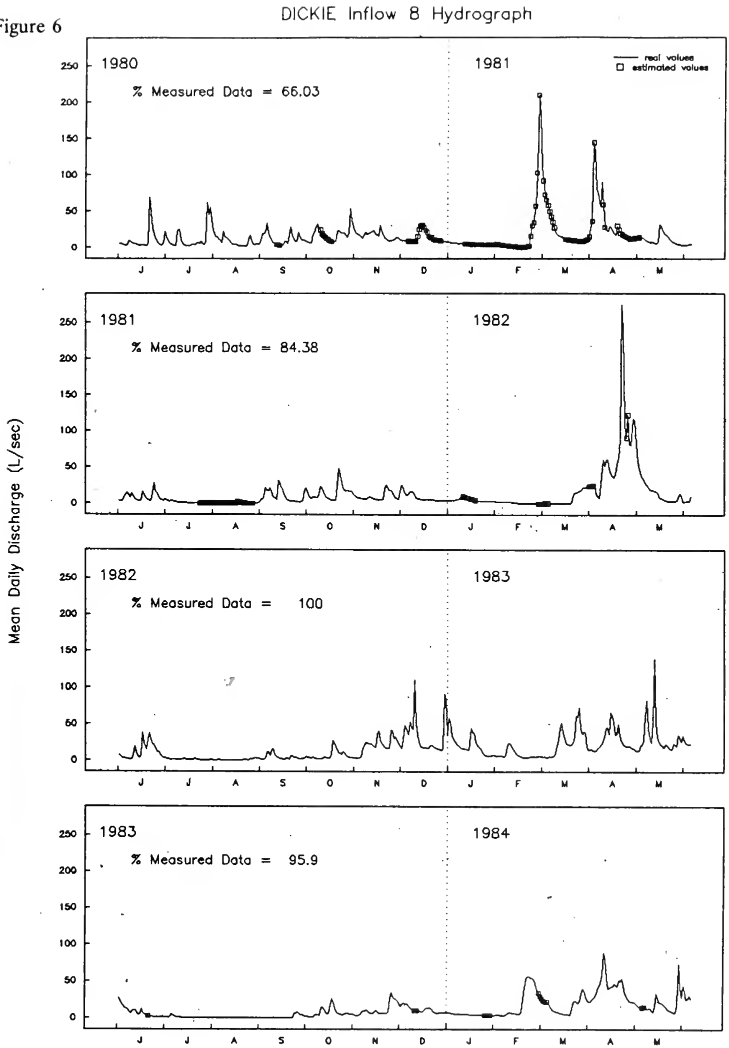

DICKIE Inflow 6 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 98.63
1989
1990
% Measured Data = 97.81
1990
1991
% Measured Data = 92.05
1991
1992
% Measured Data = 90.98
0
20
40
60
80
J J A S O N D J F M A M

Figure 6



DICKIE Inflow 8 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 66.03
1981
1982
% Measured Data = 84.38
1982
1983
% Measured Data = 100
1983
1984
% Measured Data = 95.9
0
50
100
150
200
250
J
J
A
S
O
N
D
J
F
M
A
M

Figure 6

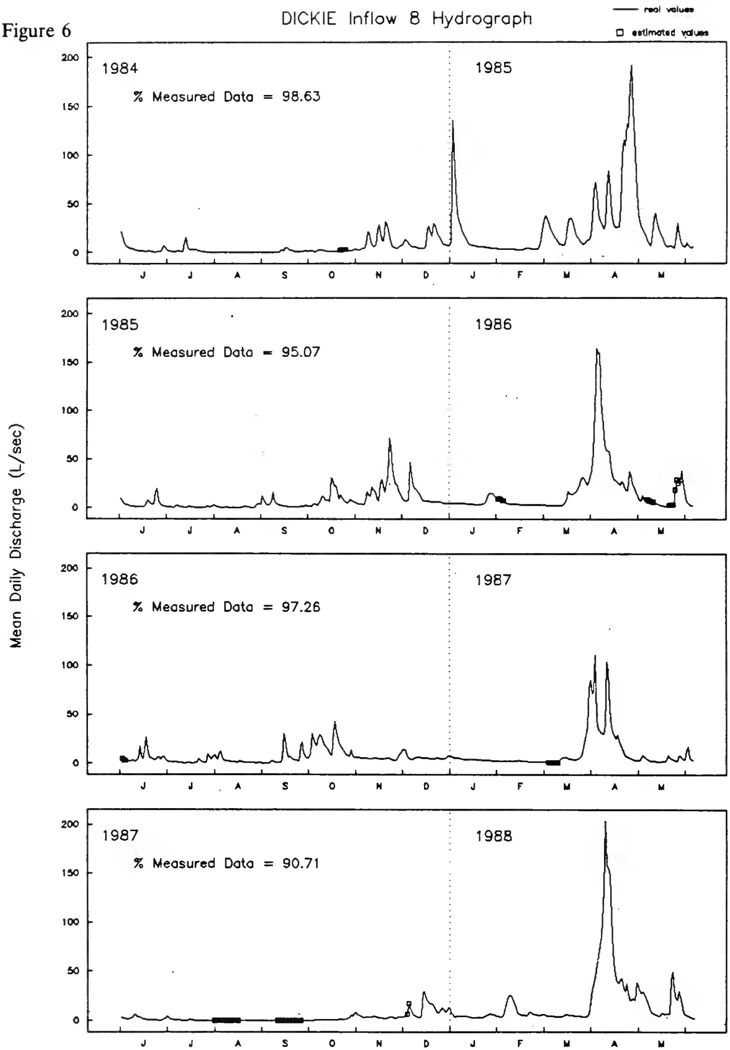

DICKIE Inflow 8 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 98.63
1985
1986
% Measured Data = 95.07
1986
1987
% Measured Data = 97.26
1987
1988
% Measured Data = 90.71
0
50
100
150
200
J J A S O N D J F M A M

Figure 6

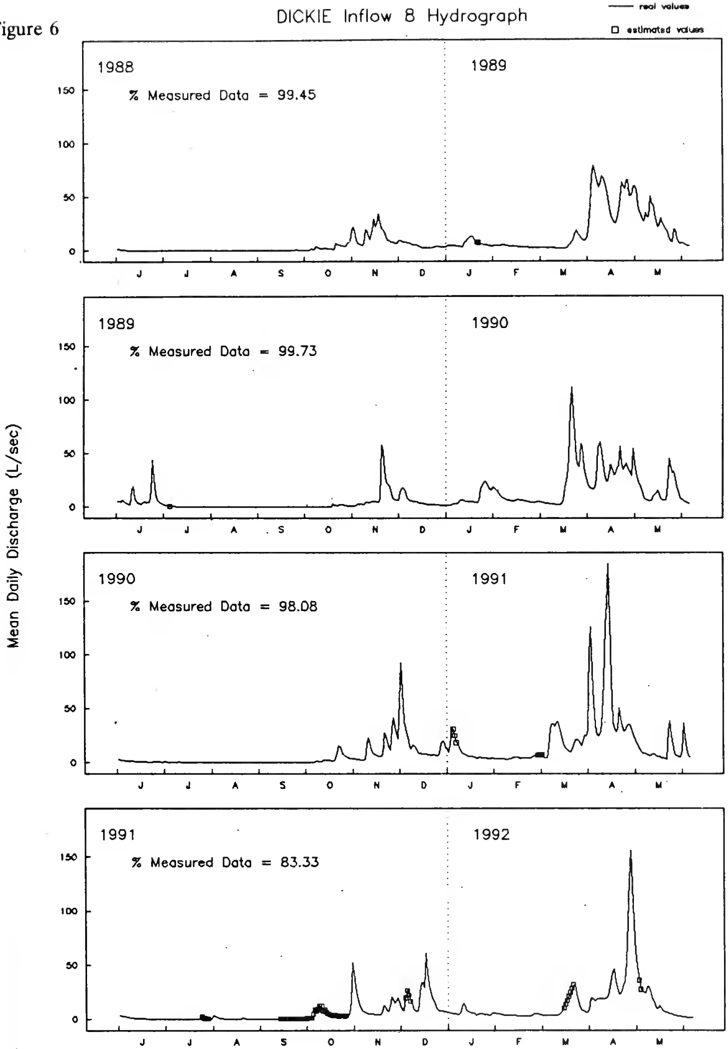

DICKIE Inflow 8 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 99.45
1989
1990
% Measured Data = 99.73
1990
1991
% Measured Data = 98.08
1991
1992
% Measured Data = 83.33
150
100
50
0
J J A S O N D J F M A M

Figure 6

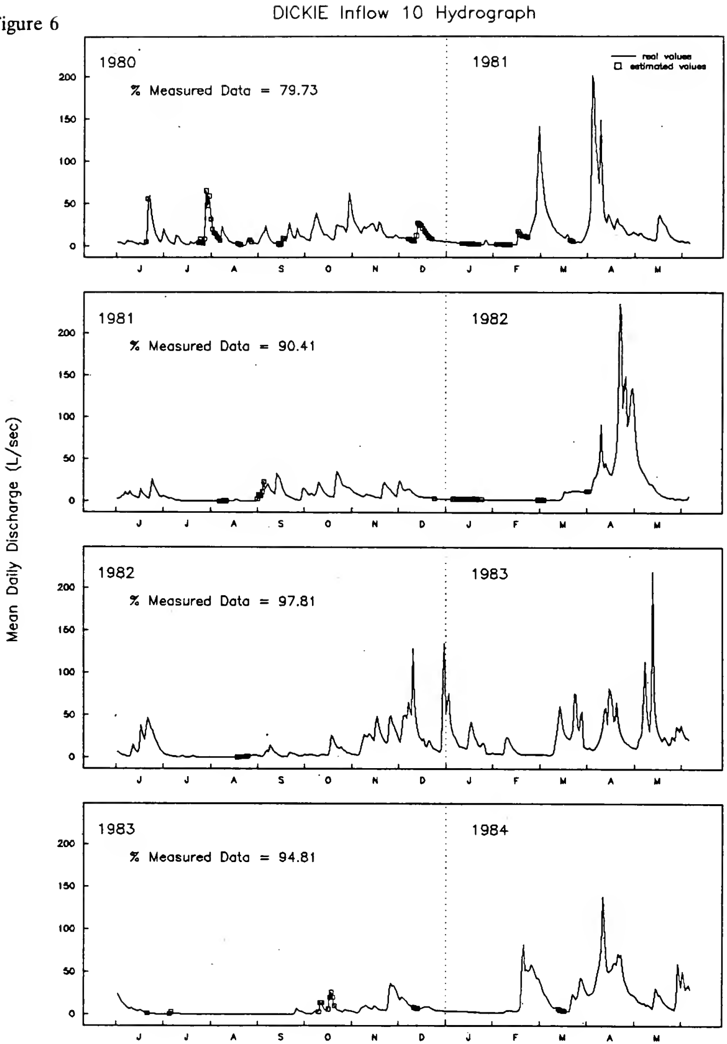

DICKIE Inflow 10 Hydrograph
real values
estimated values
1980
1981
% Measured Data = 79.73
1981
1982
% Measured Data = 90.41
1982
1983
% Measured Data = 97.81
1983
1984
% Measured Data = 94.81
Mean Daily Discharge (L/sec)
0
50
100
150
200
J J A S O N D J F M A M

Figure 6

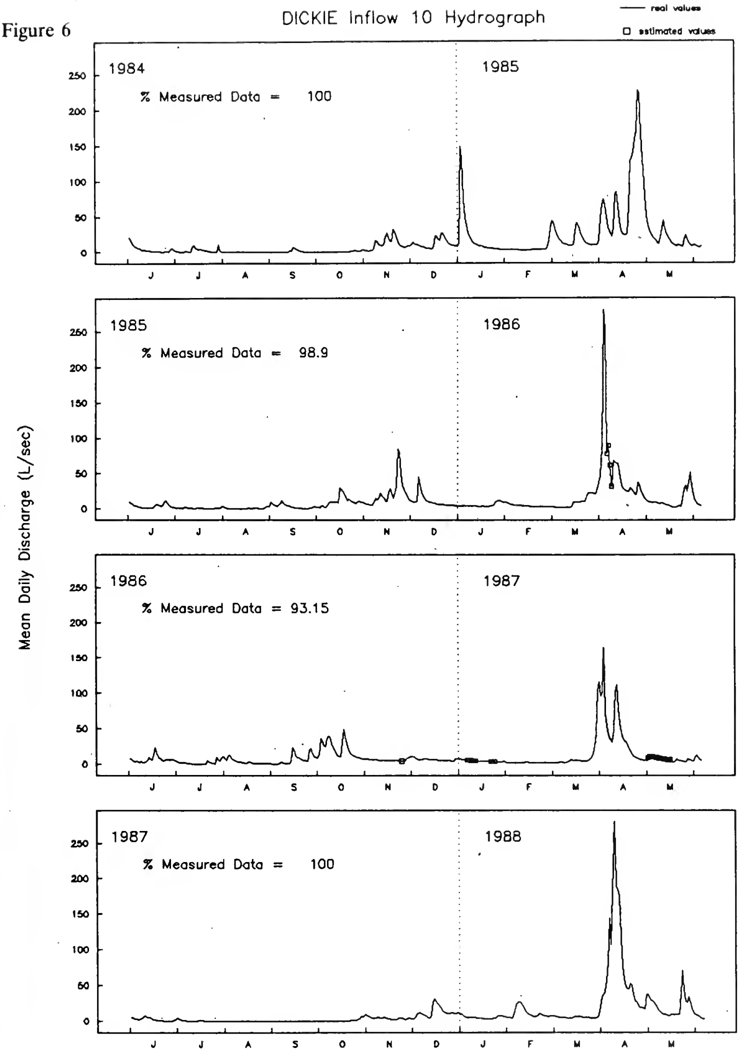

DICKIE Inflow 10 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 98.9
1986
1987
% Measured Data = 93.15
1987
1988
% Measured Data = 100
0
50
100
150
200
250
J J A S O N D J F M A M

Figure 6

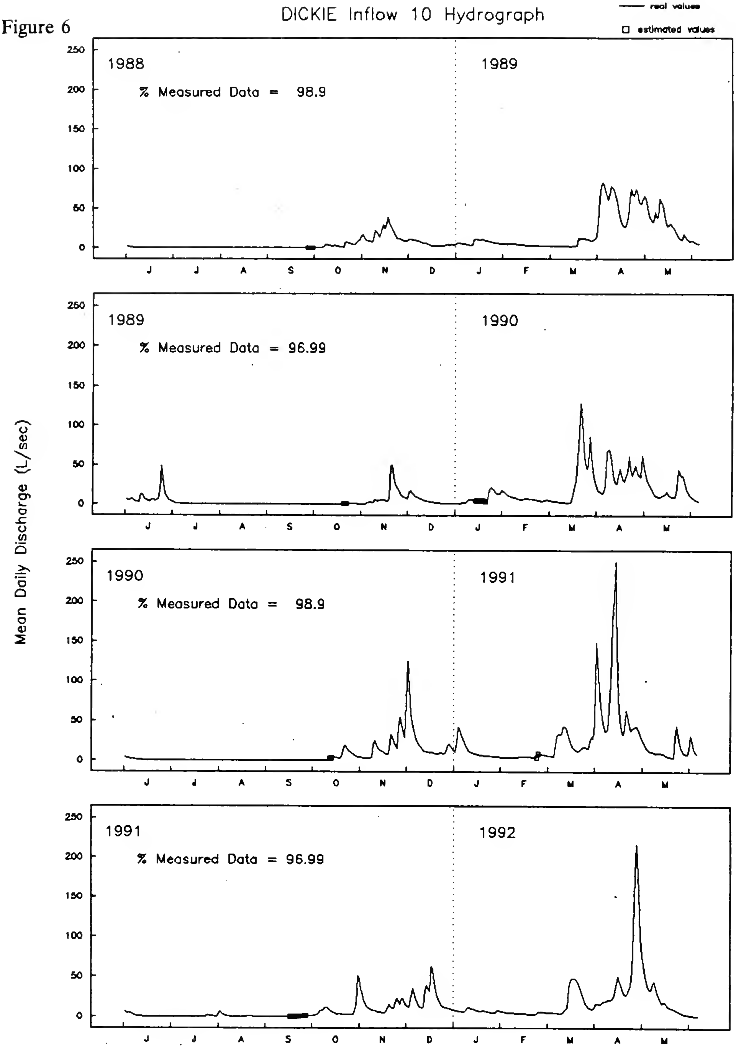

DICKIE Inflow 10 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 98.9
1989
1990
% Measured Data = 96.99
1990
1991
% Measured Data = 98.9
1991
1992
% Measured Data = 96.99
0
50
100
150
200
250
J J A S O N D J F M A M

Figure 6

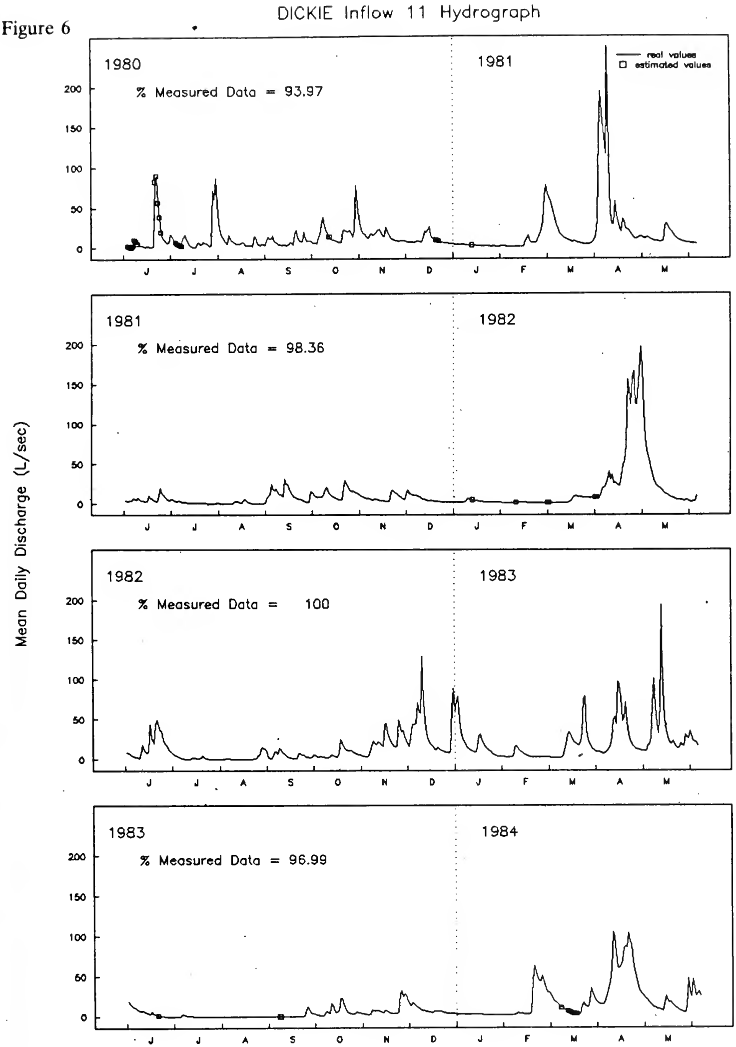
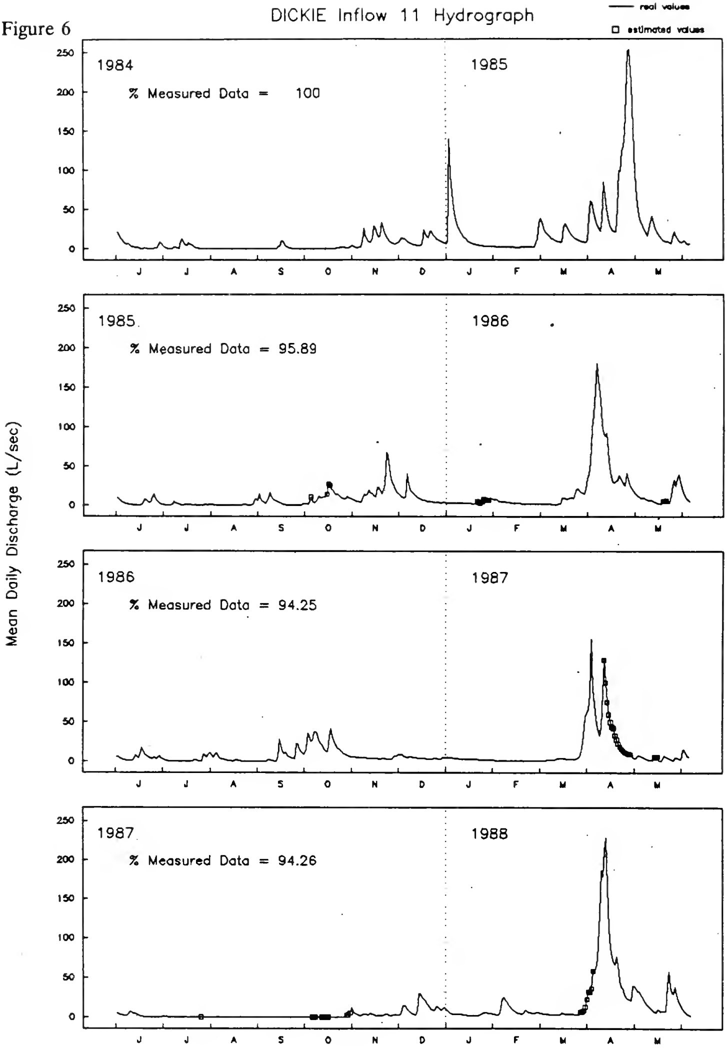
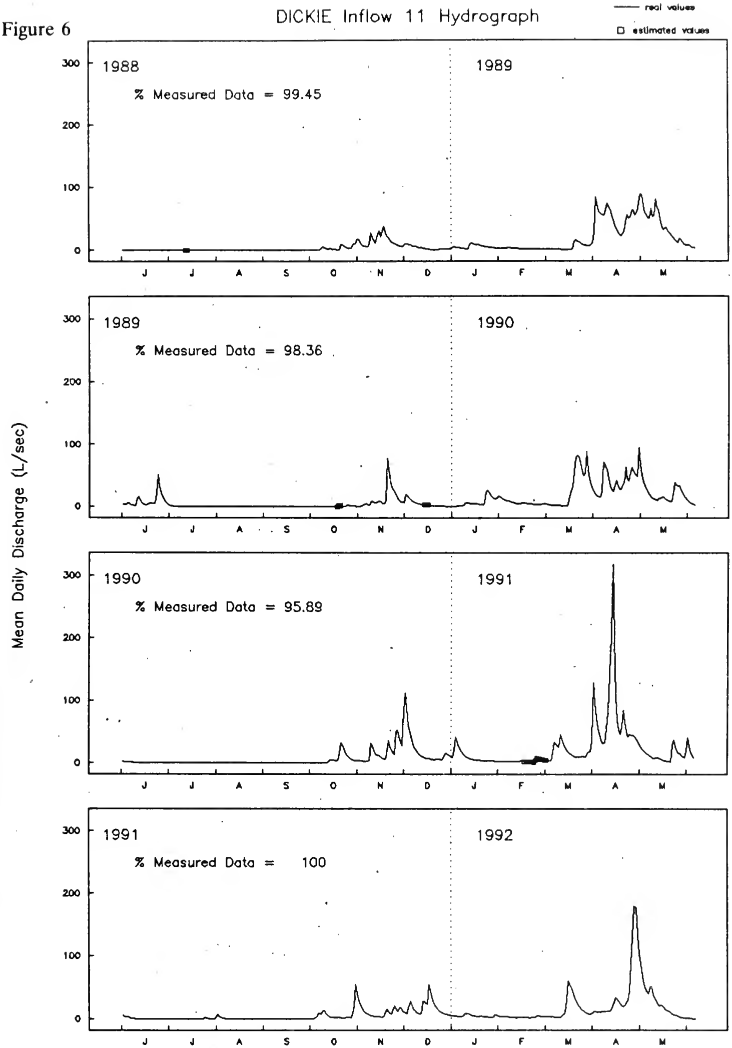

DICKIE Inflow 11 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1980
1981
% Measured Data = 93.97
1981
1982
% Measured Data = 98.36
1982
1983
% Measured Data = 100
1983
1984
% Measured Data = 96.99
0
50
100
150
200
J J A S O N D J F M A M

Figure 6



DICKIE Inflow 11 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 95.89
1986
1987
% Measured Data = 94.25
1987
1988
% Measured Data = 94.26
250
200
150
100
50
0
J J A S O N D J F M A M

Figure 6



DICKIE Inflow 11 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 99.45
1989
1990
% Measured Data = 98.36
1990
1991
% Measured Data = 95.89
1991
1992
% Measured Data = 100
300
200
100
0
J J A S O N D J F M A M

Figure 6

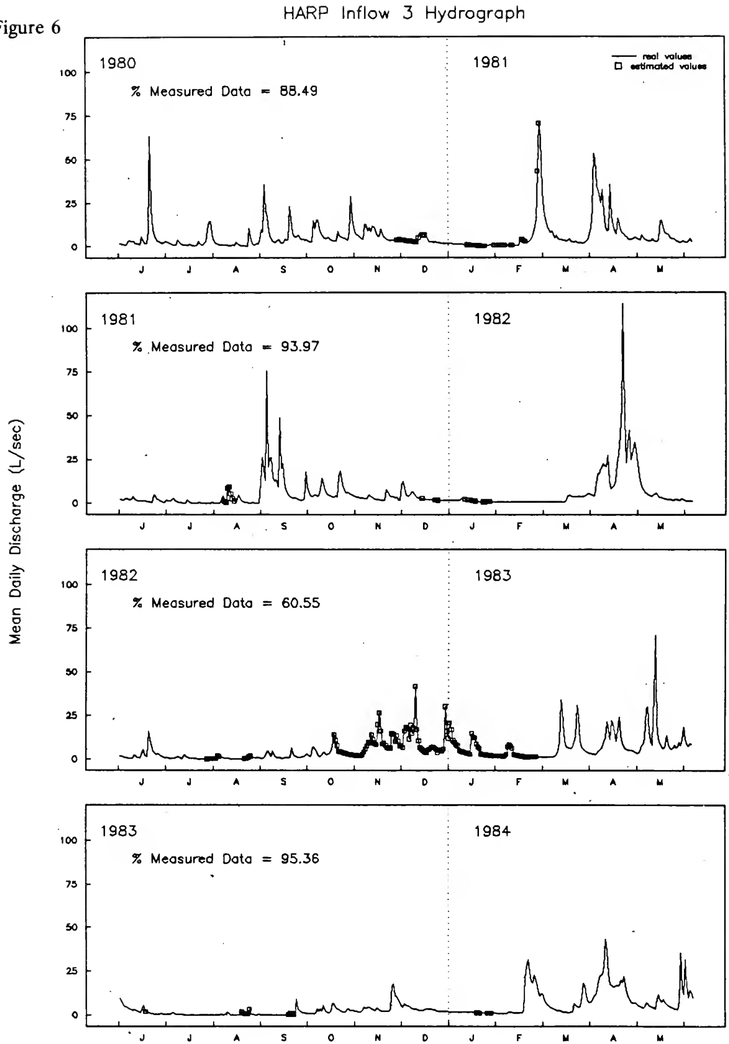

HARP Inflow 3 Hydrograph
real values
estimated values
1980
1981
% Measured Data = 88.49
1981
1982
% Measured Data = 93.97
1982
1983
% Measured Data = 60.55
1983
1984
% Measured Data = 95.36
Mean Daily Discharge (L/sec)
0
25
50
75
100
J
J
A
S
O
N
D
J
F
M
A
M

Figure 6

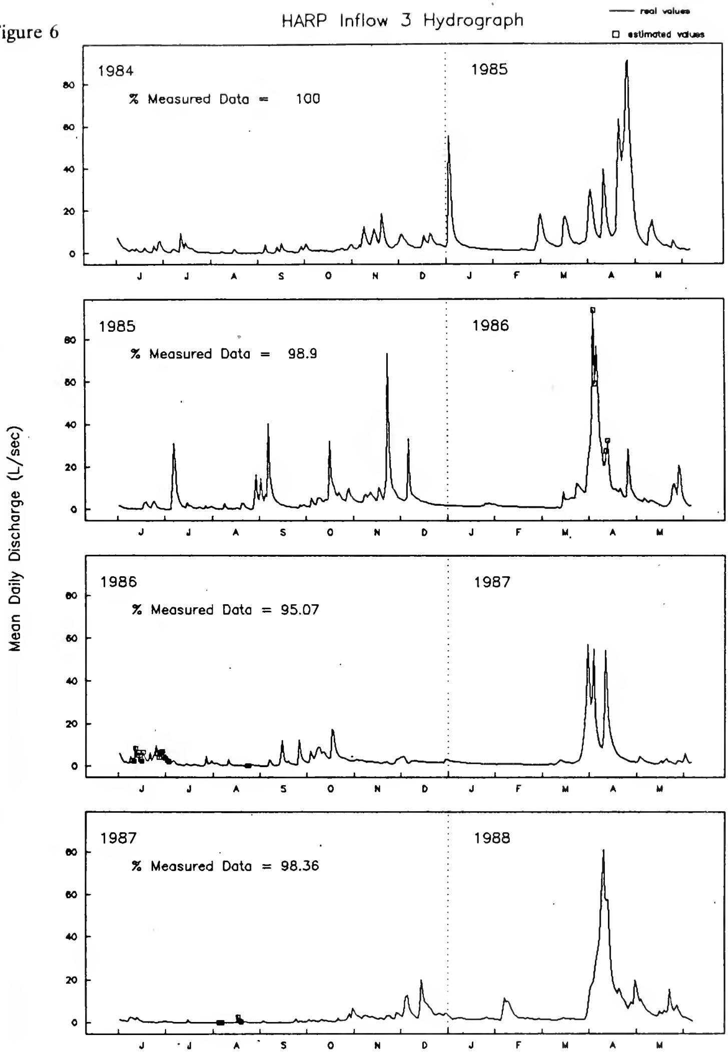

HARP Inflow 3 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 98.9
1986
1987
% Measured Data = 95.07
1987
1988
% Measured Data = 98.36
J J A S O N D J F M A M

Figure 6

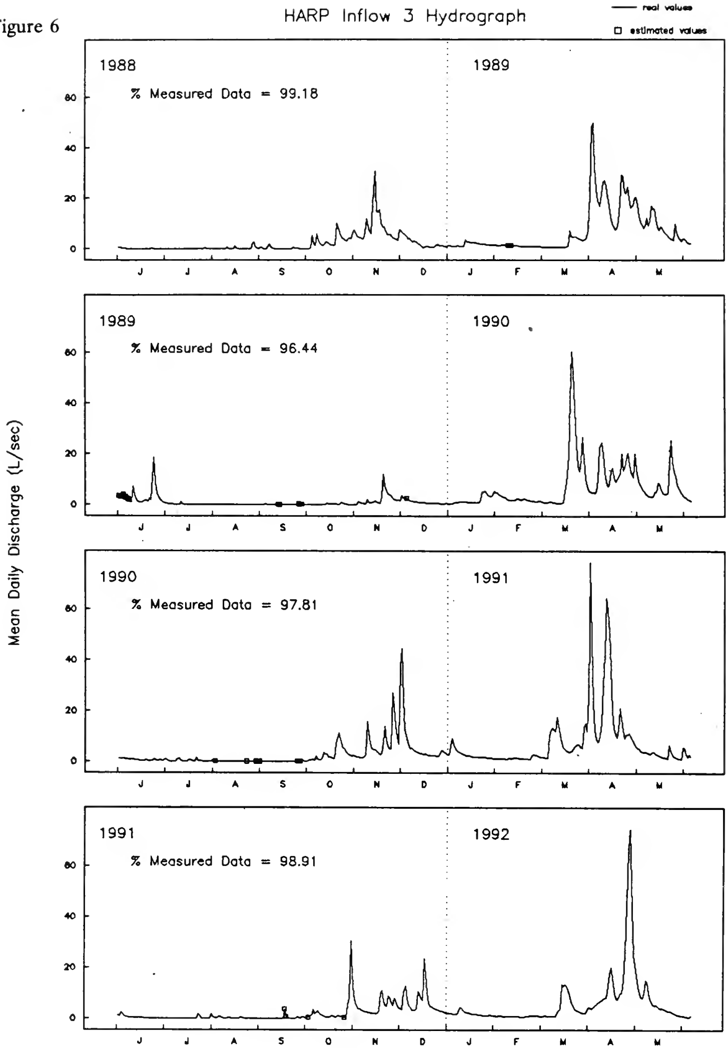

HARP Inflow 3 Hydrograph
real values
estimated values
1988
1989
% Measured Data = 99.18
1989
1990
% Measured Data = 96.44
1990
1991
% Measured Data = 97.81
1991
1992
% Measured Data = 98.91
Mean Daily Discharge (L/sec)
0
20
40
60
J J A S O N D J F M A M

Figure 6

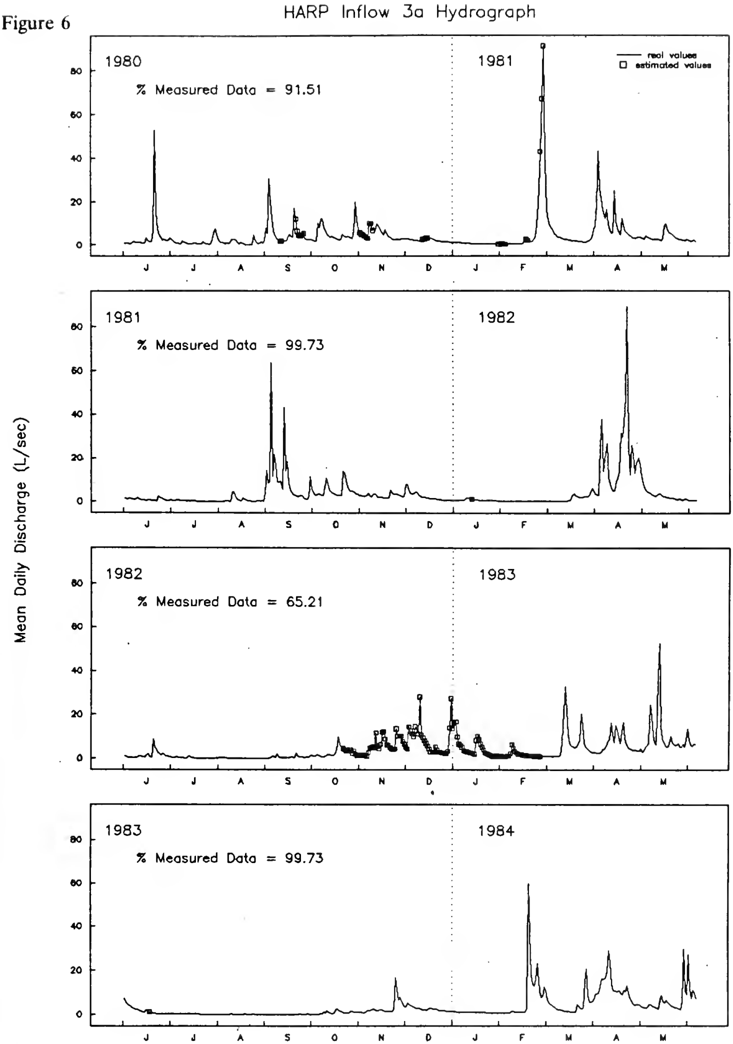
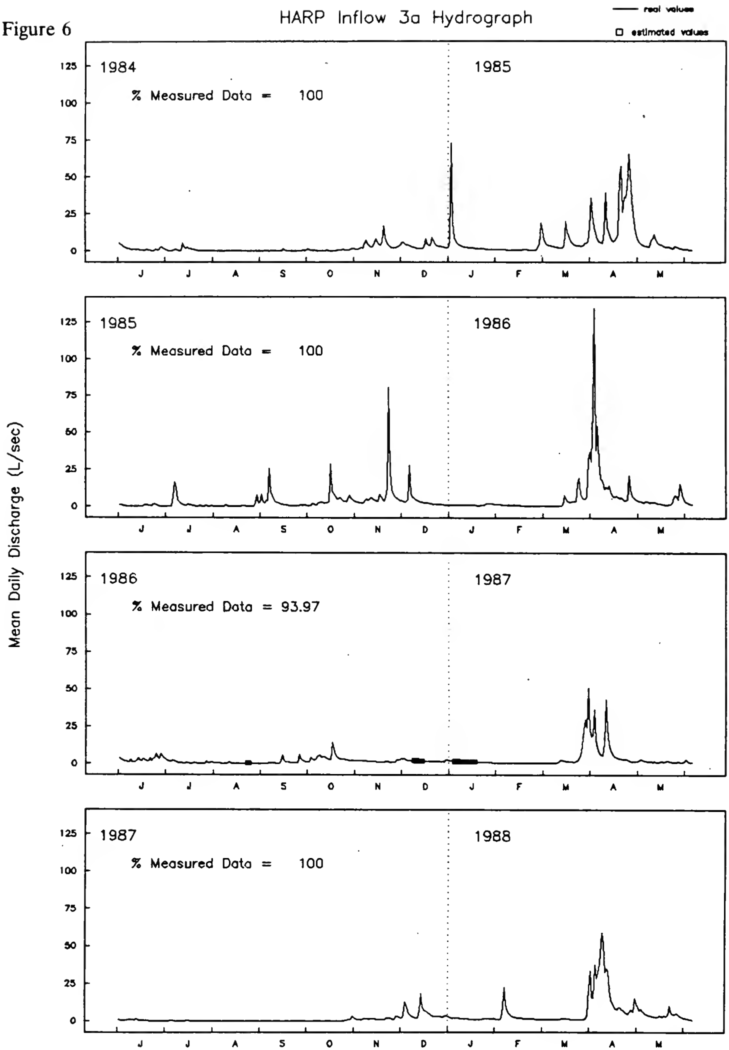

HARP Inflow 3a Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 91.51
1981
1982
% Measured Data = 99.73
1982
1983
% Measured Data = 65.21
1983
1984
% Measured Data = 99.73
J J A S O N D J F M A M

Figure 6



HARP Inflow 3a Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 100
1986
1987
% Measured Data = 93.97
1987
1988
% Measured Data = 100
125
100
75
50
25
0
J J A S O N D J F M A M

Figure 6

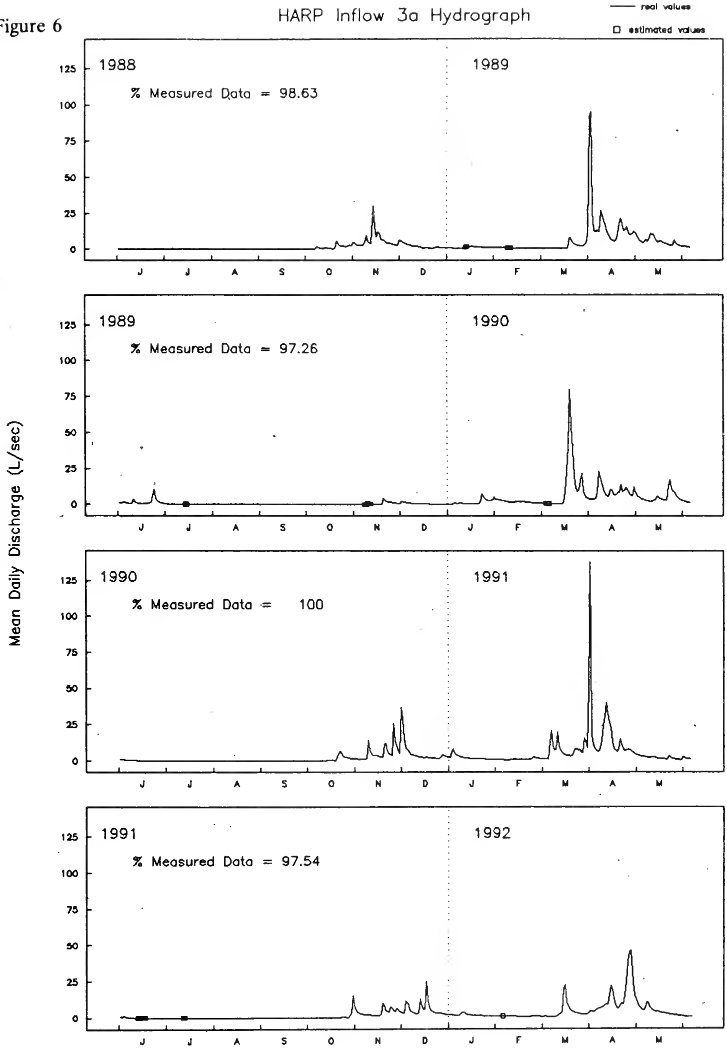

HARP Inflow 3a Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 98.63
1989
1990
% Measured Data = 97.26
1990
1991
% Measured Data = 100
1991
1992
% Measured Data = 97.54
0
25
50
75
100
125
J J A S O N D J F M A M

Figure 6

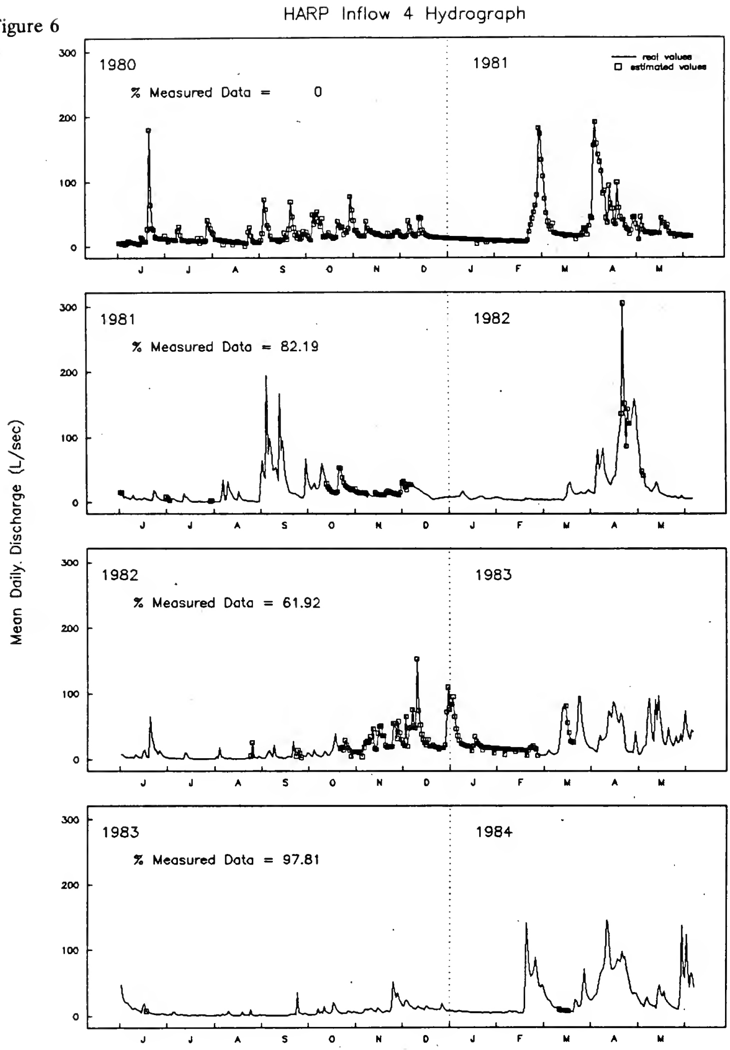

HARP Inflow 4 Hydrograph
Mean Daily. Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 0
1981
1982
% Measured Data = 82.19
1982
1983
% Measured Data = 61.92
1983
1984
% Measured Data = 97.81
0
100
200
300
J J A S O N D J F M A M

Figure 6

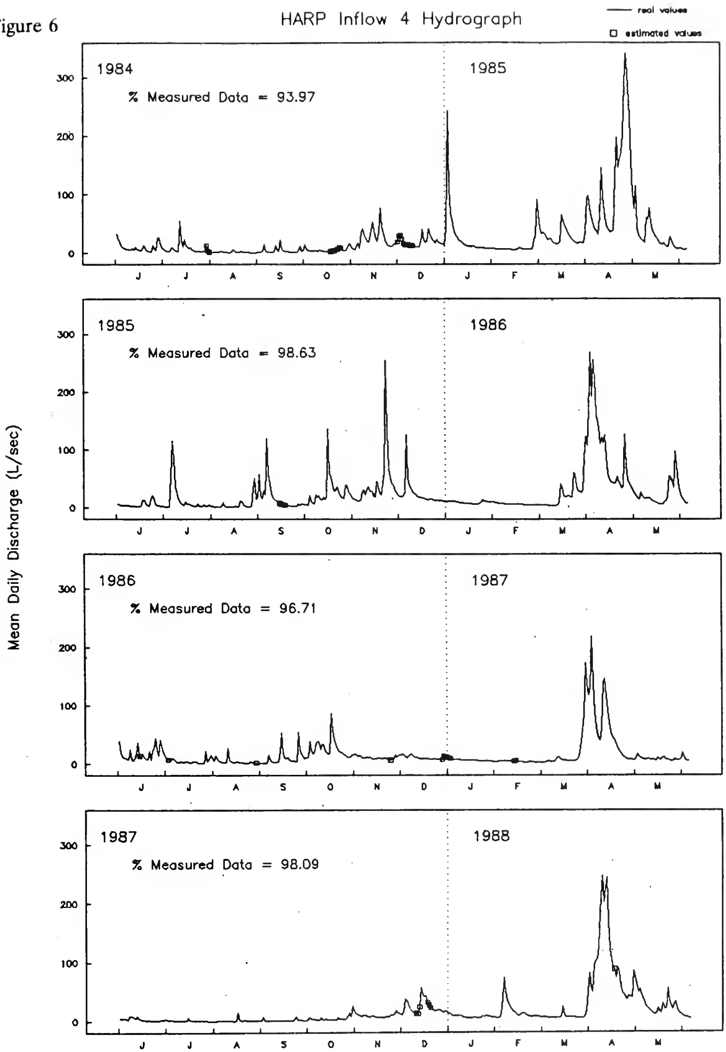

HARP Inflow 4 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 93.97
1985
1986
% Measured Data = 98.63
1986
1987
% Measured Data = 96.71
1987
1988
% Measured Data = 98.09
300
200
100
0
J J A S O N D J F M A M

Figure 6

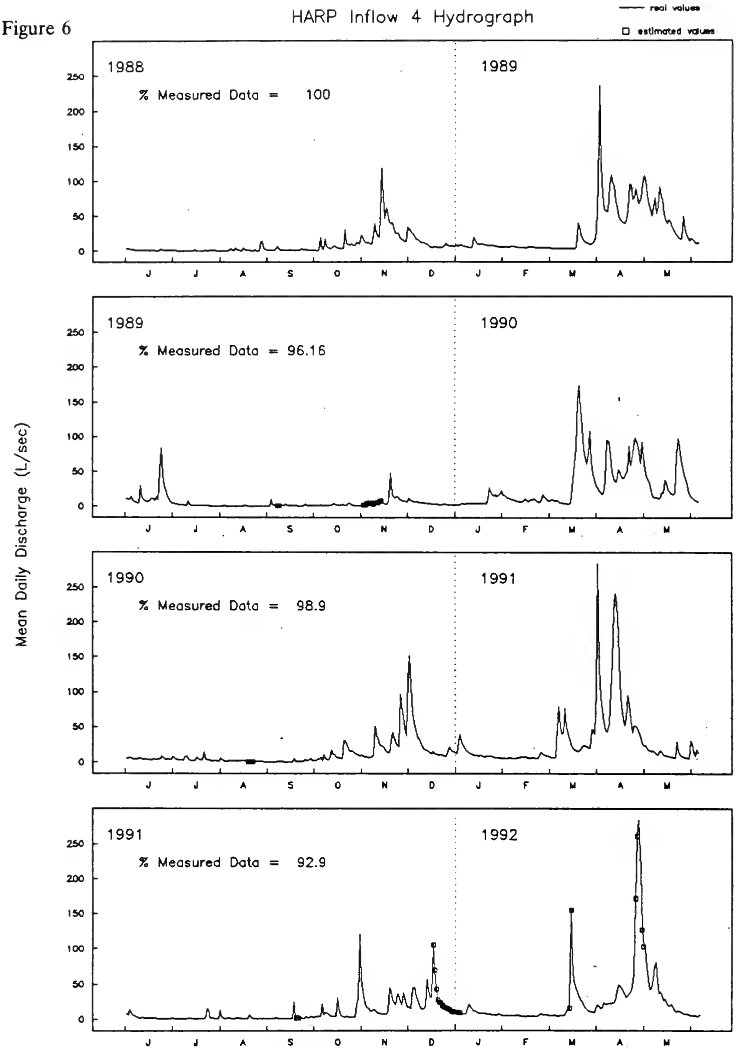

HARP Inflow 4 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 100
1989
1990
% Measured Data = 96.16
1990
1991
% Measured Data = 98.9
1991
1992
% Measured Data = 92.9
0
50
100
150
200
250
J J A S O N D J F M A M

Figure 6

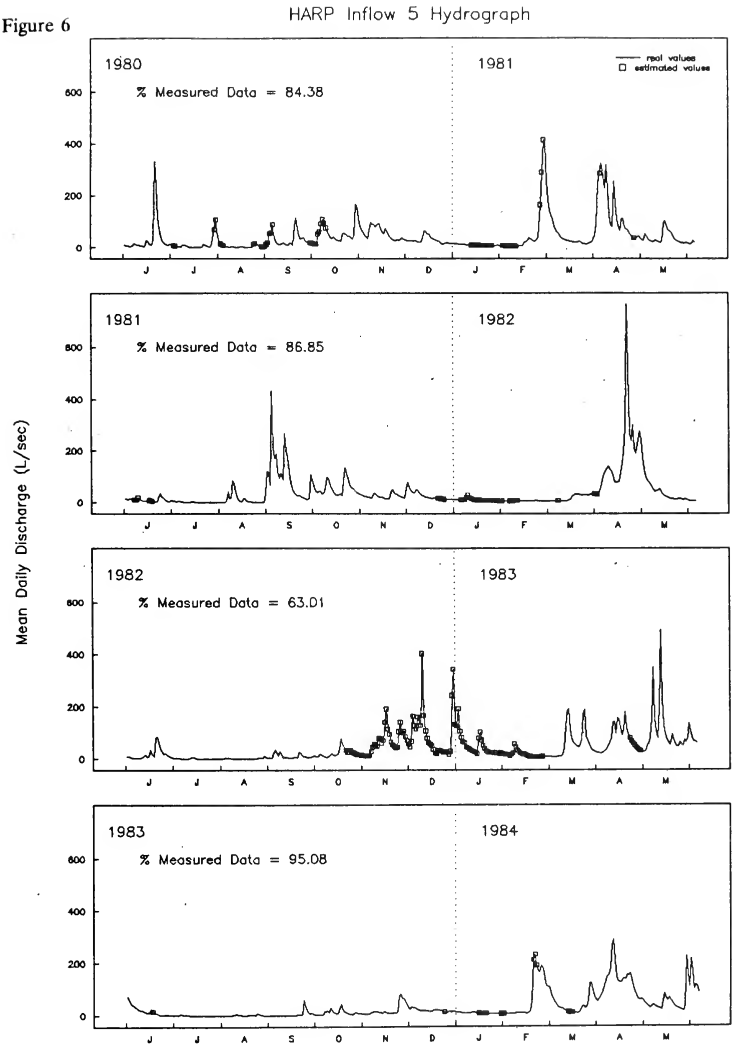
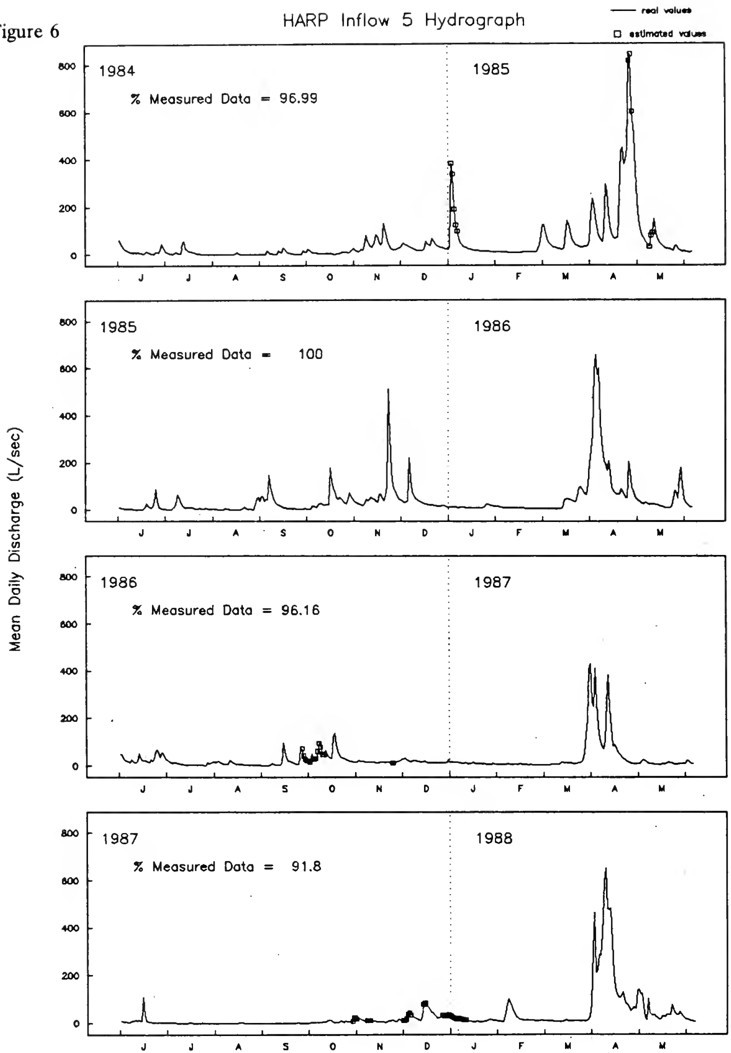
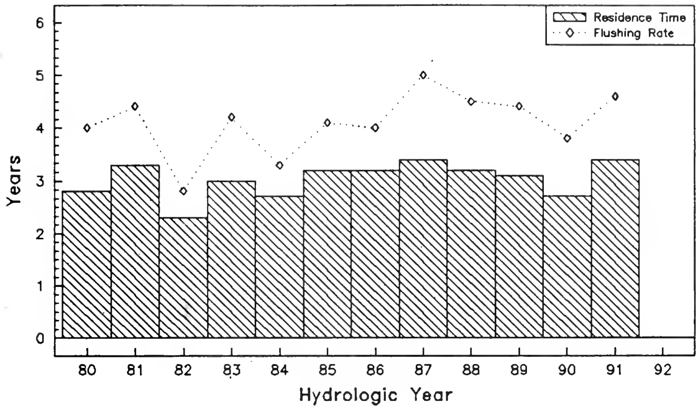

HARP Inflow 5 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 84.38
1981
1982
% Measured Data = 86.85
1982
1983
% Measured Data = 63.01
1983
1984
% Measured Data = 95.08
0
200
400
600
J J A S O N D J F M A M

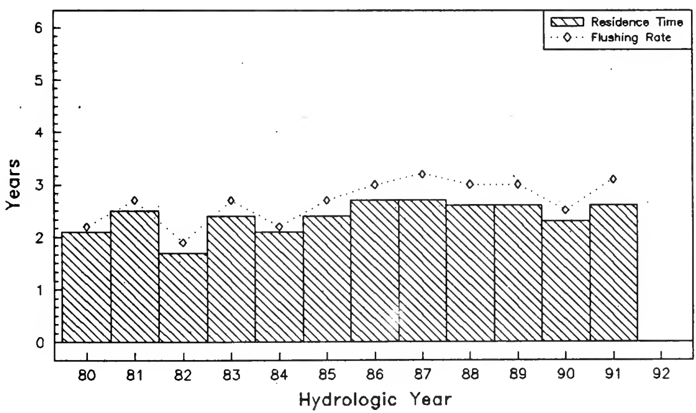
Figure 6

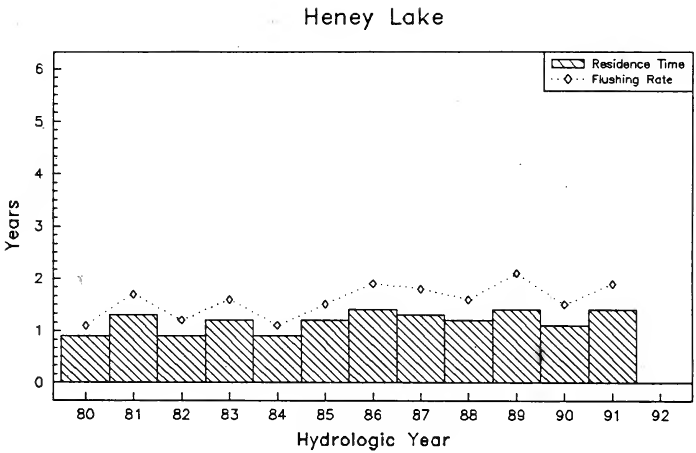

HARP Inflow 5 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 96.99
1985
1986
% Measured Data = 100
1986
1987
% Measured Data = 96.16
1987
1988
% Measured Data = 91.8
0
200
400
600
800
J J A S O N D J F M A M

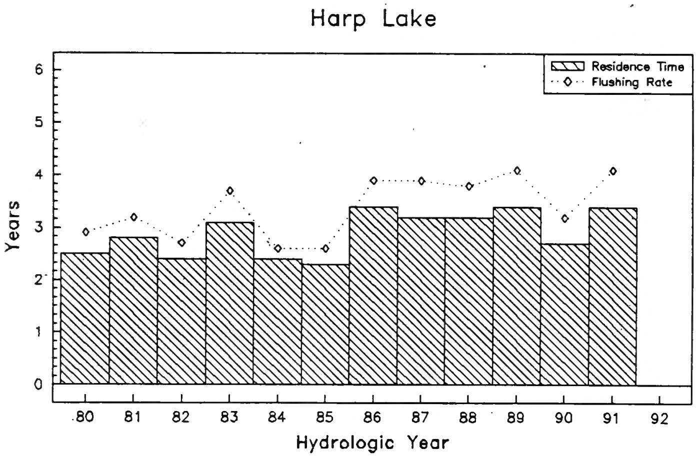
Plastic Lake



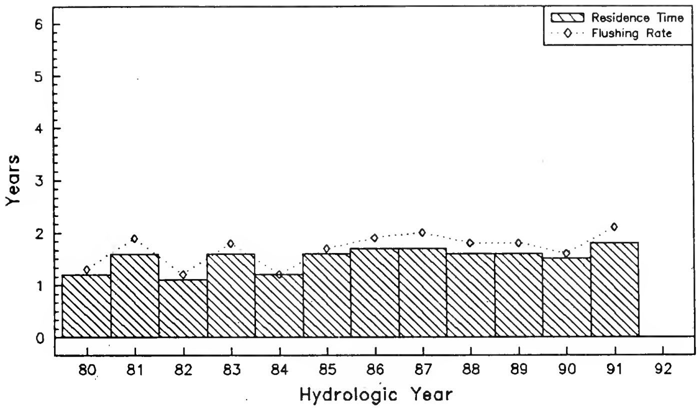
Red Chalk Lake



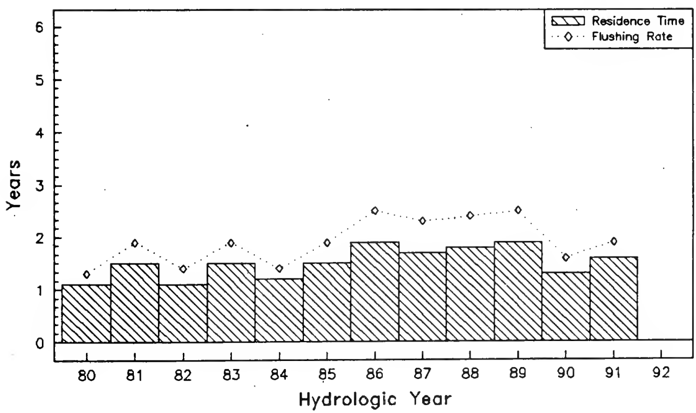

Heney Lake
Residence Time
Flushing Rate
Years
0
1
2
3
4
5
6
80
81
82
83
84
85
86
87
88
89
90
91
92
Hydrologic Year


Harp Lake
Residence Time
Flushing Rate
Years
0
1
2
3
4
5
6
80
81
82
83
84
85
86
87
88
89
90
91
92
Hydrologic Year

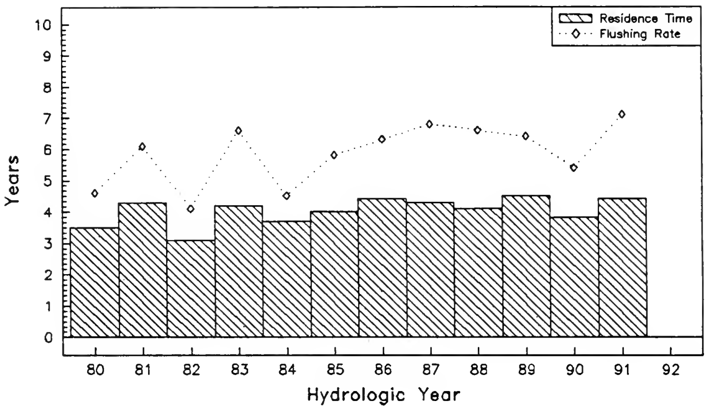
Crosson Lake



Dickie Lake



Blue Chalk Lake



Chub Lake

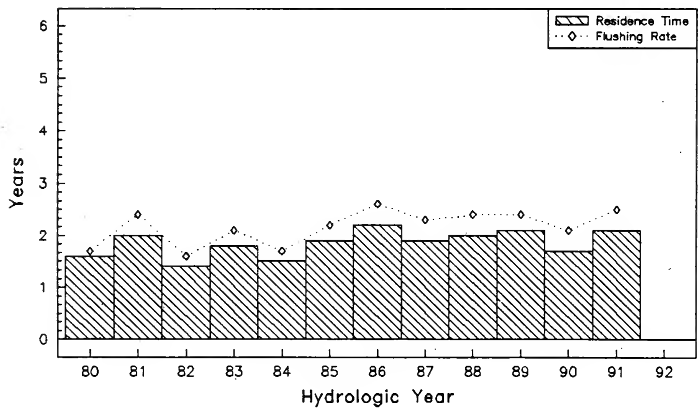
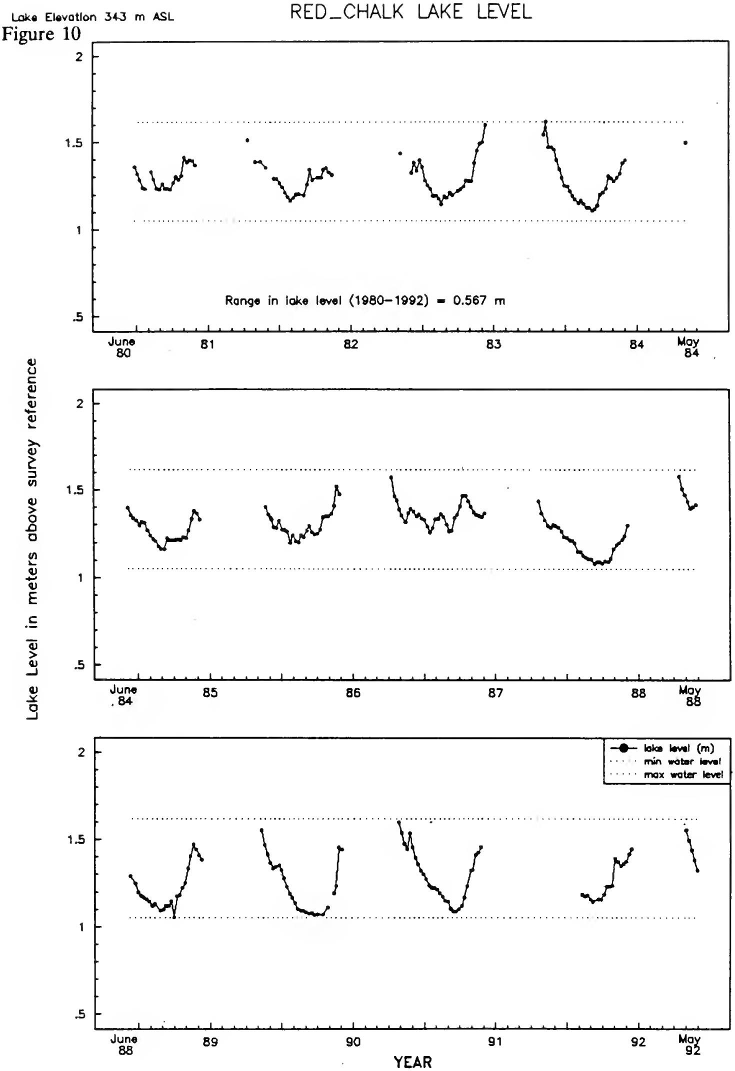


Figure 11 Annual residence and flushing time for 8 study lakes, 1980-1992.

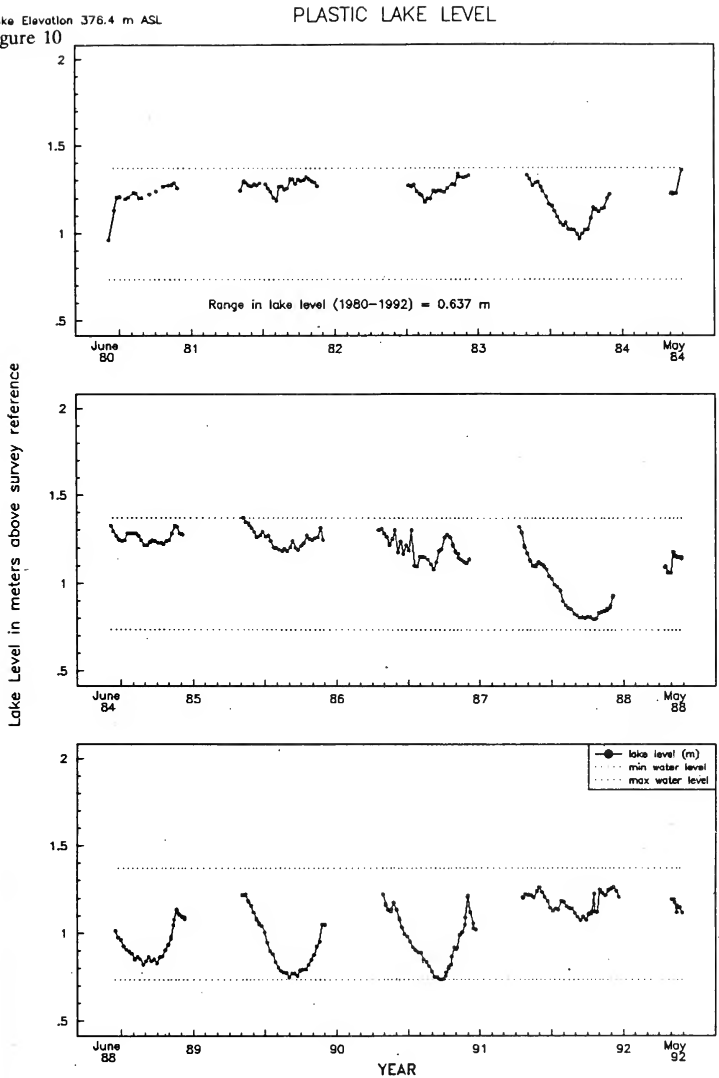
Blue Chalk, Chub
Crosson, Dickie
Heney, Harp
Plastic, Red Chalk

Figure 10



Lake Elevation 343 m ASL
RED_CHALK LAKE LEVEL
Range in lake level (1980–1992) = 0.567 m
Lake Level in meters above survey reference
2
1.5
1
.5
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92
YEAR
lake level (m)
min water level
max water level

Figure 10



Lake Elevation 376.4 m ASL
PLASTIC LAKE LEVEL
Lake Level in meters above survey reference
2
1.5
1
.5
Range in lake level (1980–1992) = 0.637 m
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
lake level (m)
min water level
max water level
June 88
89
90
91
92
May 92
YEAR

Figure 10

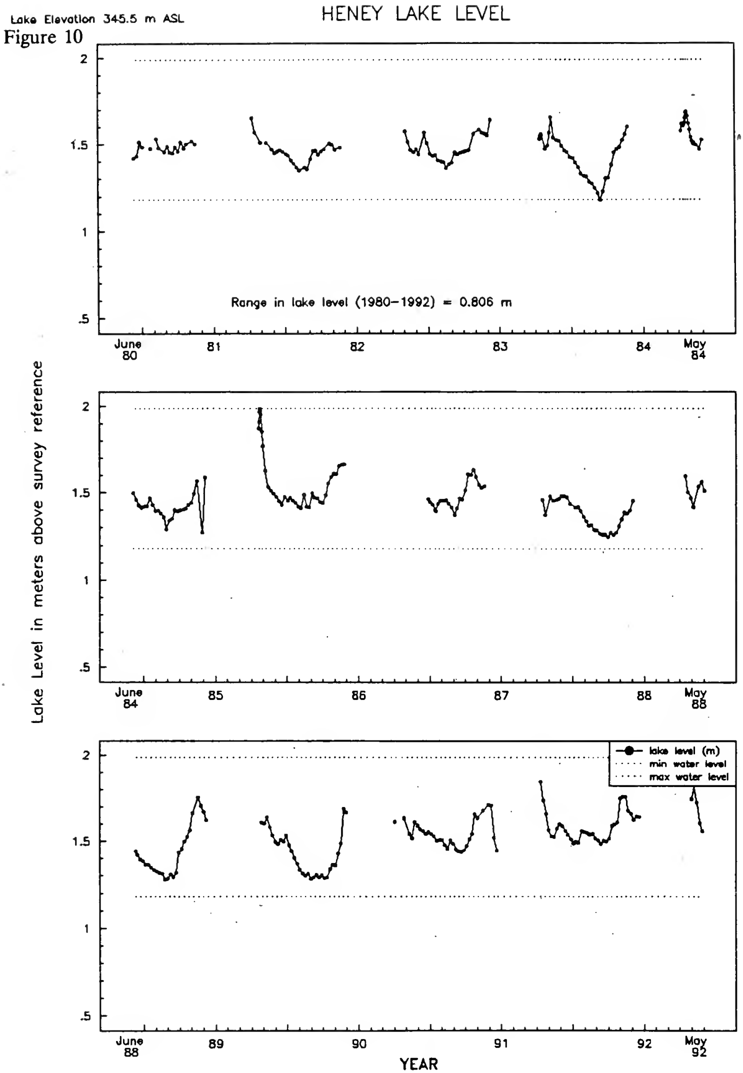
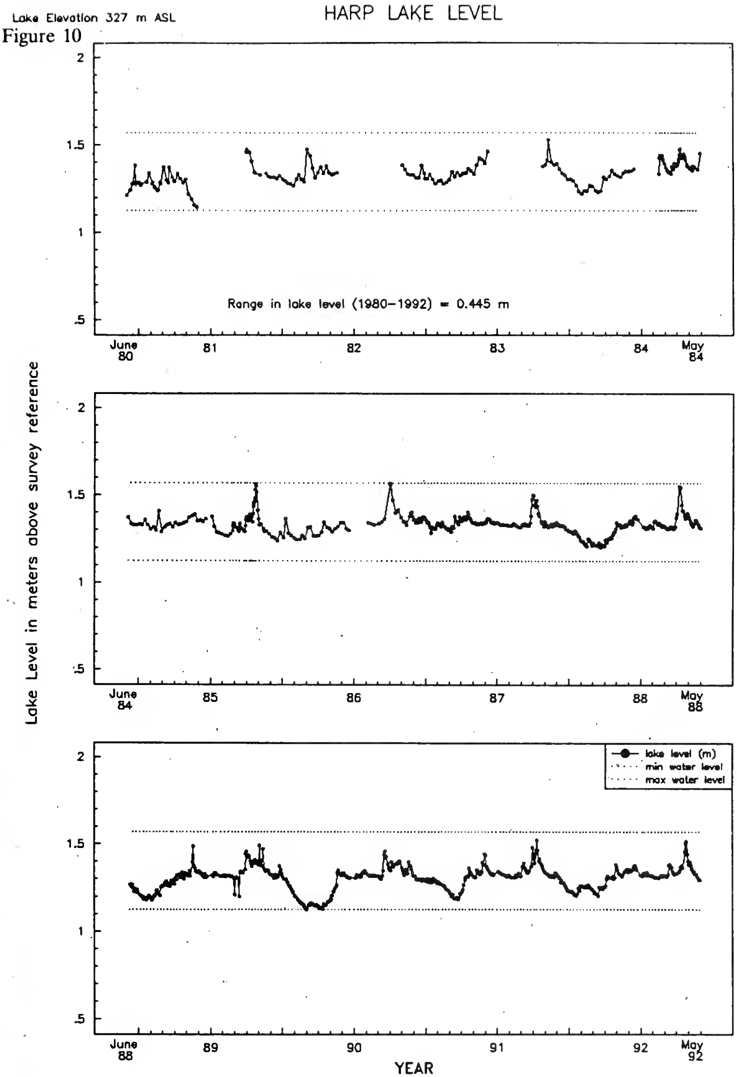

Lake Elevation 345.5 m ASL
HENEY LAKE LEVEL
Lake Level in meters above survey reference
2
1.5
1
.5
Range in lake level (1980-1992) = 0.806 m
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
lake level (m)
min water level
max water level
June 88
89
90
91
92
May 92
YEAR

Figure 10



Lake Elevation 327 m ASL
HARP LAKE LEVEL
Range in lake level (1980–1992) = 0.445 m
Lake Level in meters above survey reference
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92
YEAR
lake level (m)
min water level
max water level

Figure 10

DICKIE LAKE LEVEL

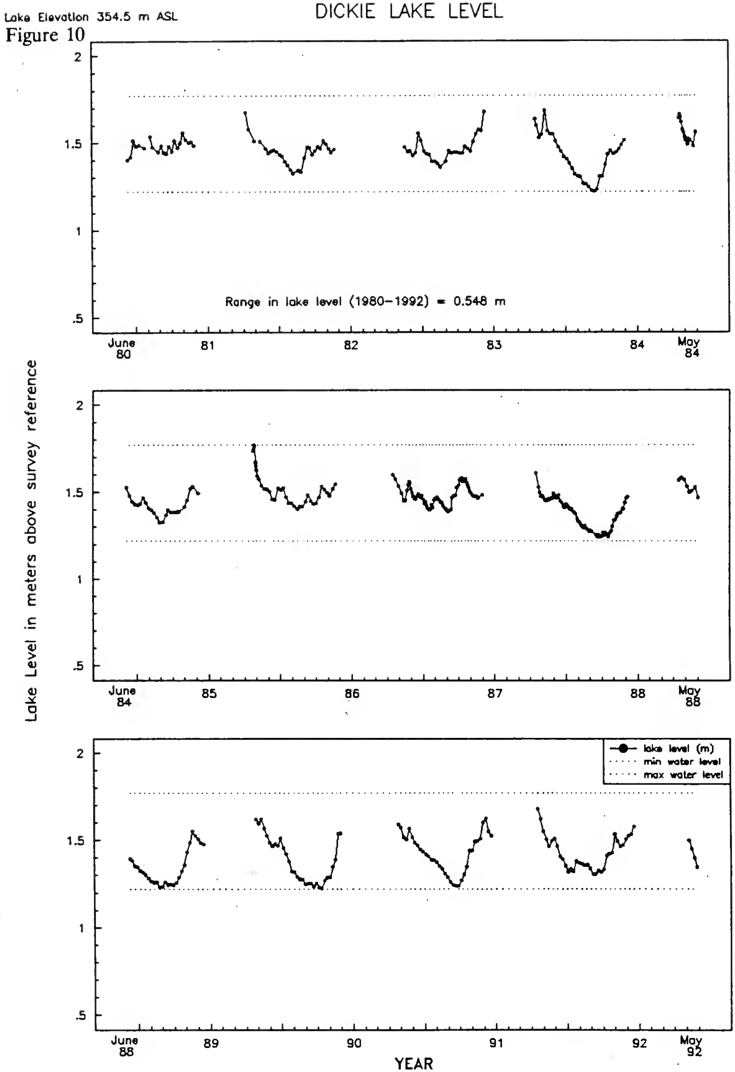
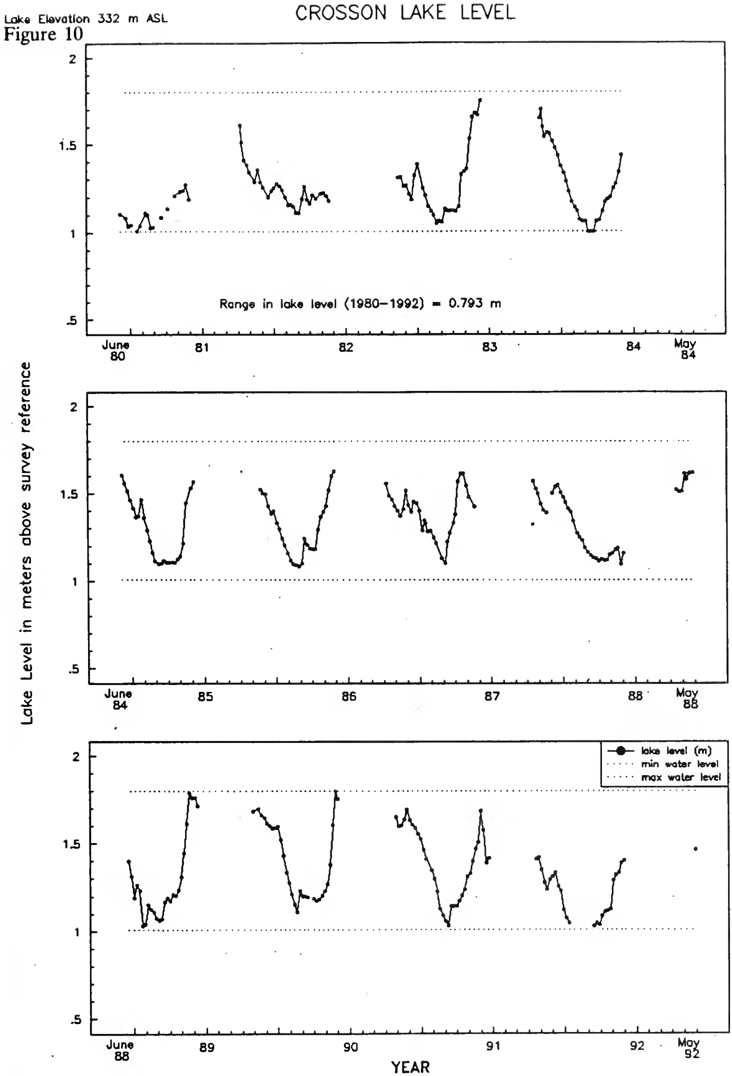
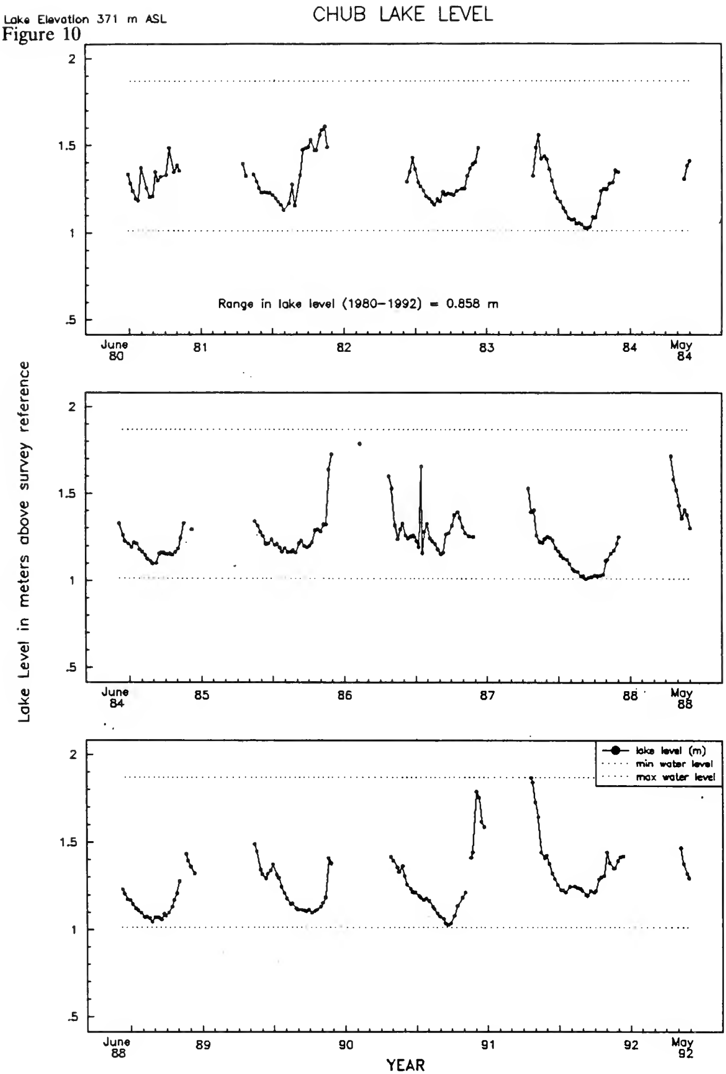


Figure 10



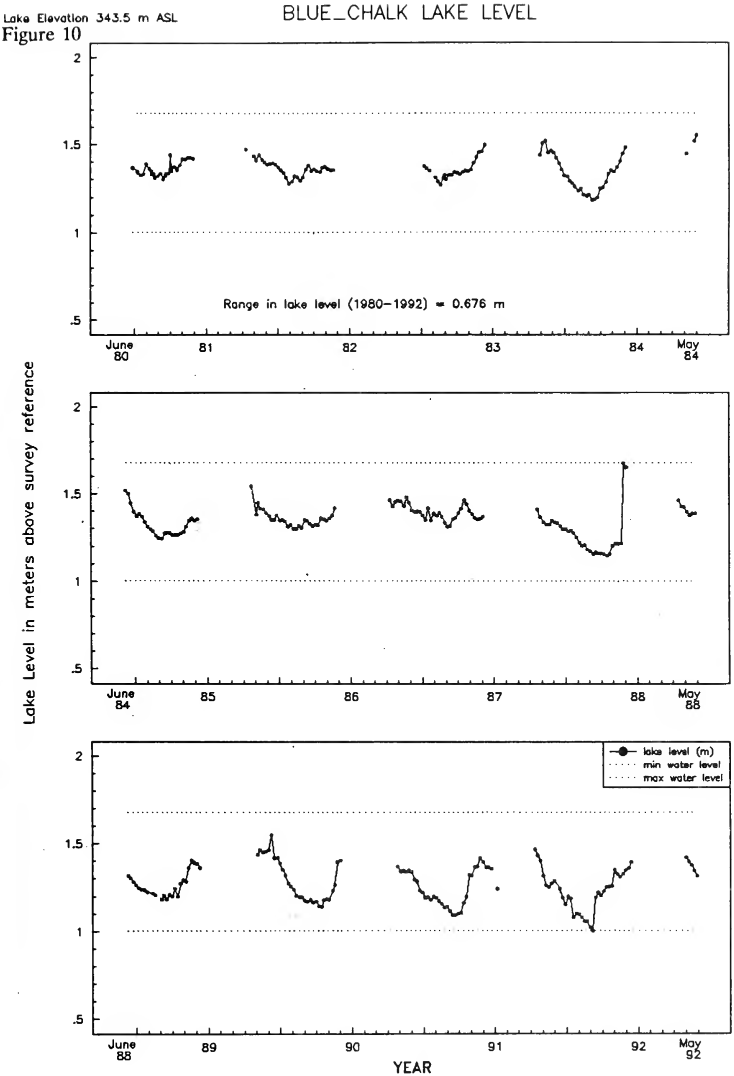
Lake Elevation 332 m ASL
CROSSON LAKE LEVEL
Range in lake level (1980–1992) = 0.793 m
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92
2
1.5
1
.5
Lake Level in meters above survey reference
lake level (m)
min water level
max water level
YEAR

Figure 10



Lake Elevation 371 m ASL
CHUB LAKE LEVEL
Range in lake level (1980–1992) = 0.858 m
Lake Level in meters above survey reference
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92
YEAR
lake level (m)
min water level
max water level
2
1.5
1
.5

Figure 10

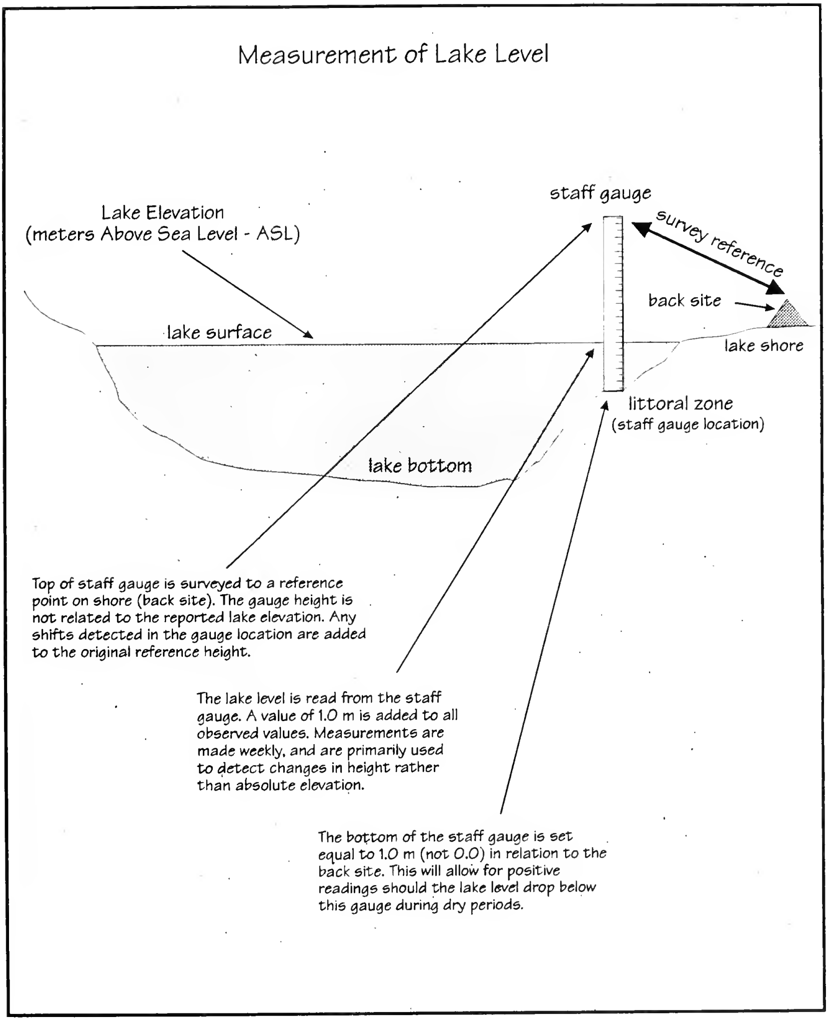


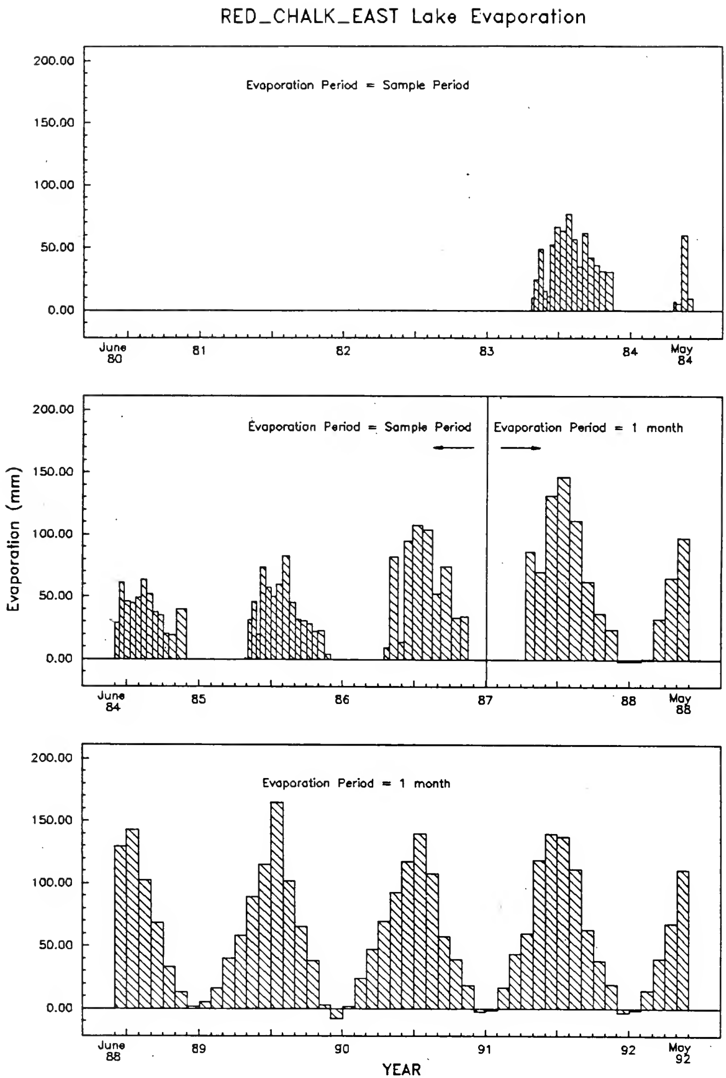
Lake Elevation 343.5 m ASL
BLUE_CHALK LAKE LEVEL
Range in lake level (1980–1992) = 0.676 m
Lake Level in meters above survey reference
2
1.5
1
.5
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92
YEAR
lake level (m)
min water level
max water level

Figure 10 Lake level gauge (m) for 8 study lakes, 1980-1992.

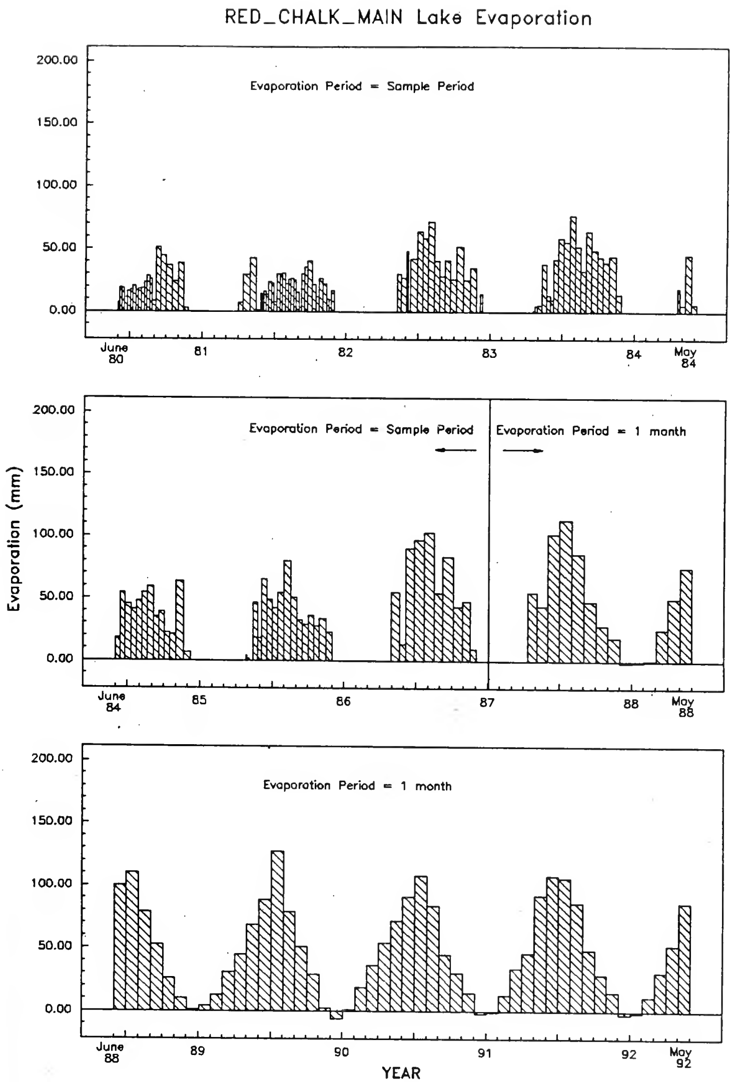
Blue Chalk
Chub
Crosson
Dickie
Harp
Heney
Plastic
Red Chalk

Figure 9 Measurement of lake level.

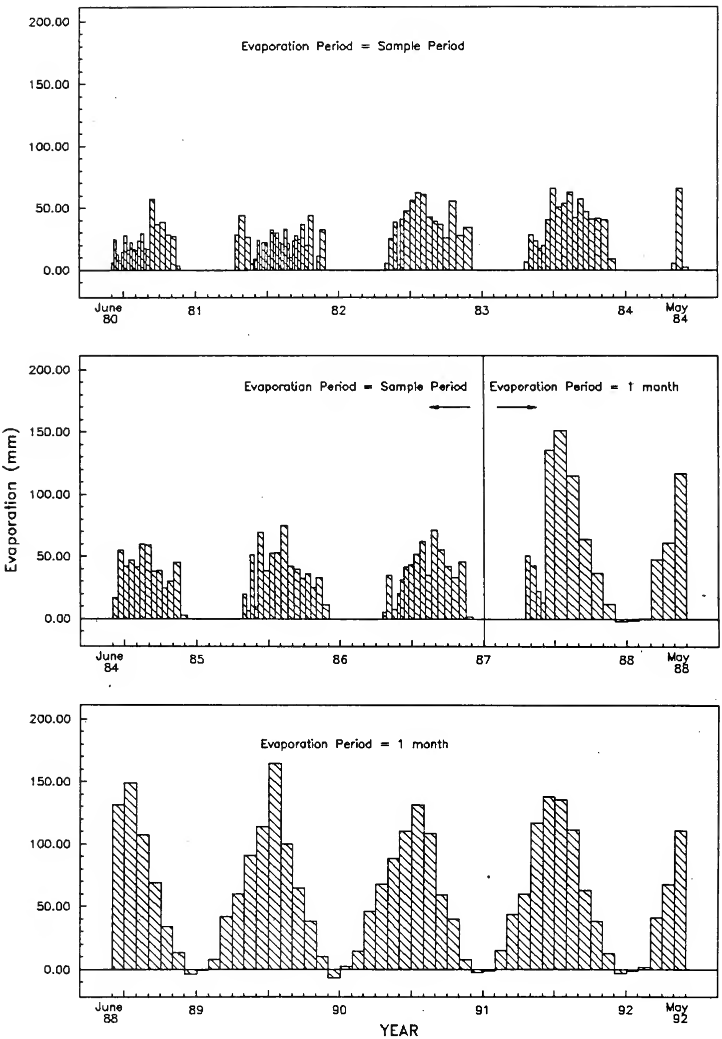




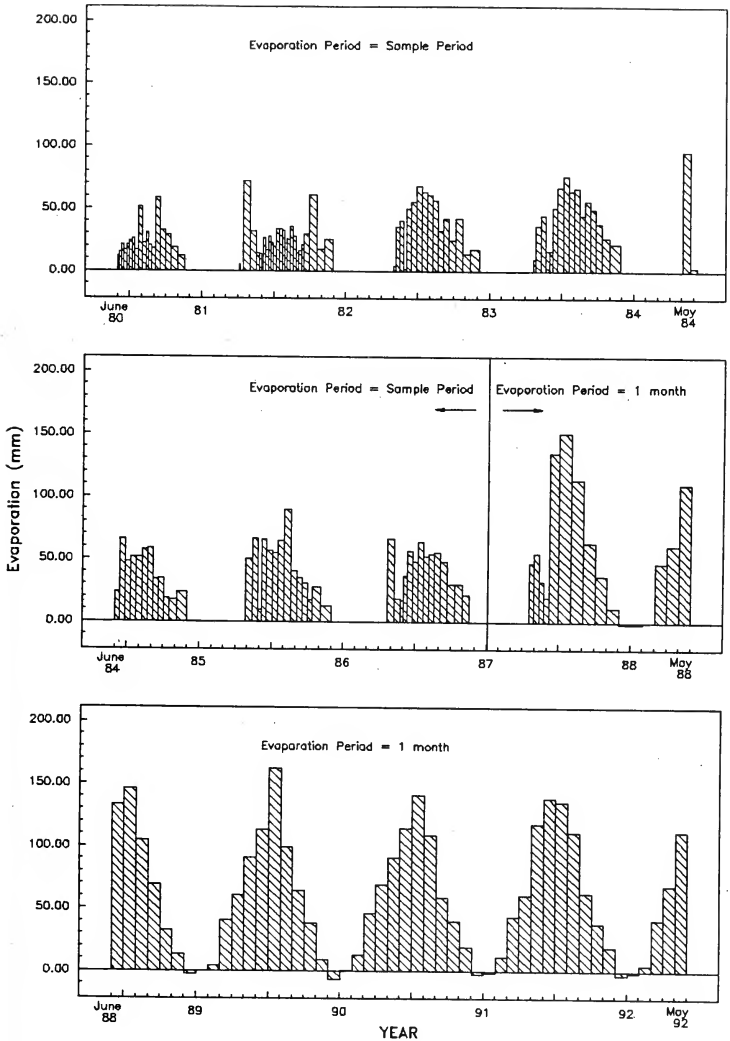
RED_CHALK_EAST Lake Evaporation
Evaporation Period = Sample Period
Evaporation Period = 1 month
Evaporation (mm)
200.00
150.00
100.00
50.00
0.00
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92
YEAR


RED_CHALK_MAIN Lake Evaporation
Evaporation Period = Sample Period
Evaporation Period = 1 month
Evaporation (mm)
200.00
150.00
100.00
50.00
0.00
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92
YEAR

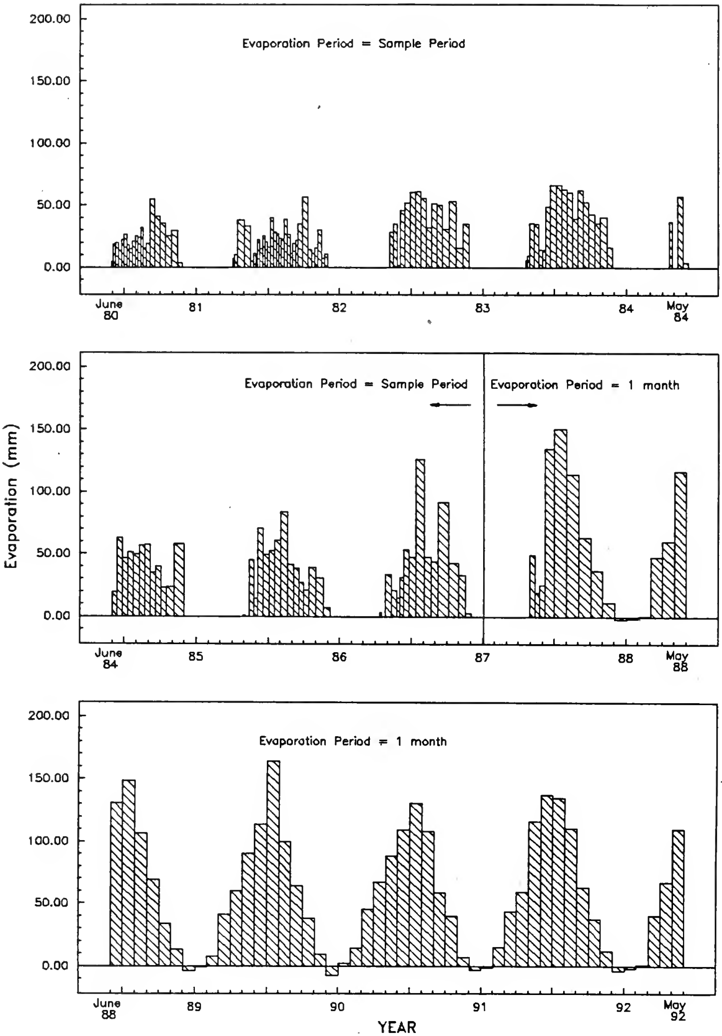
PLASTIC Lake Evaporation

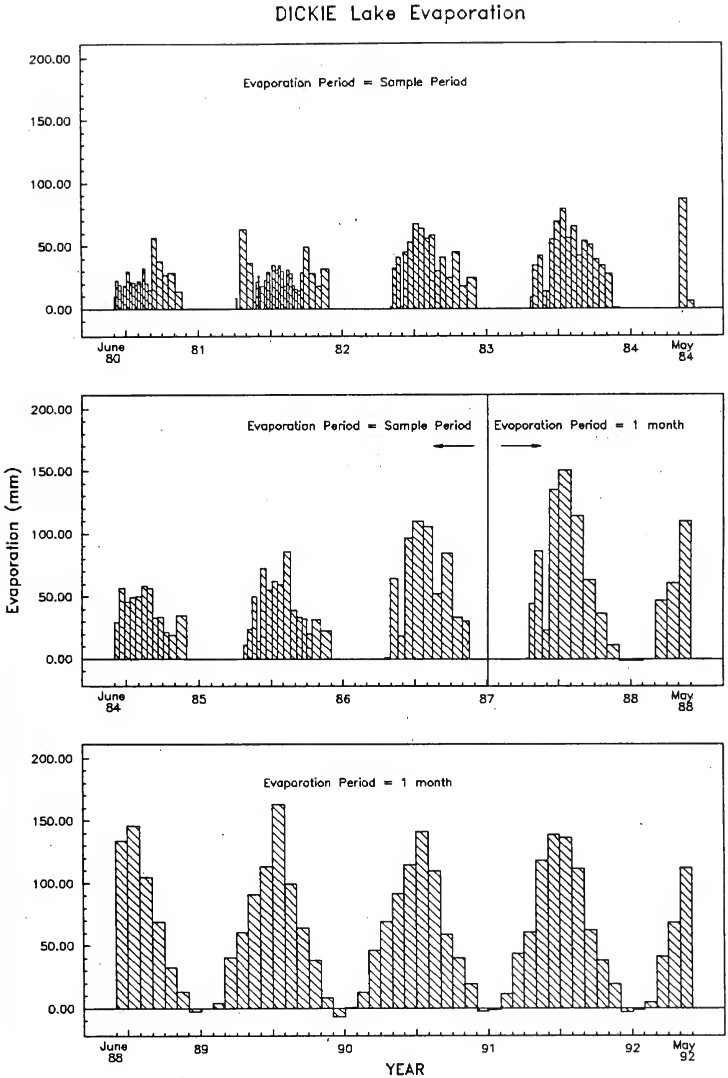


HENEY Lake Evaporation

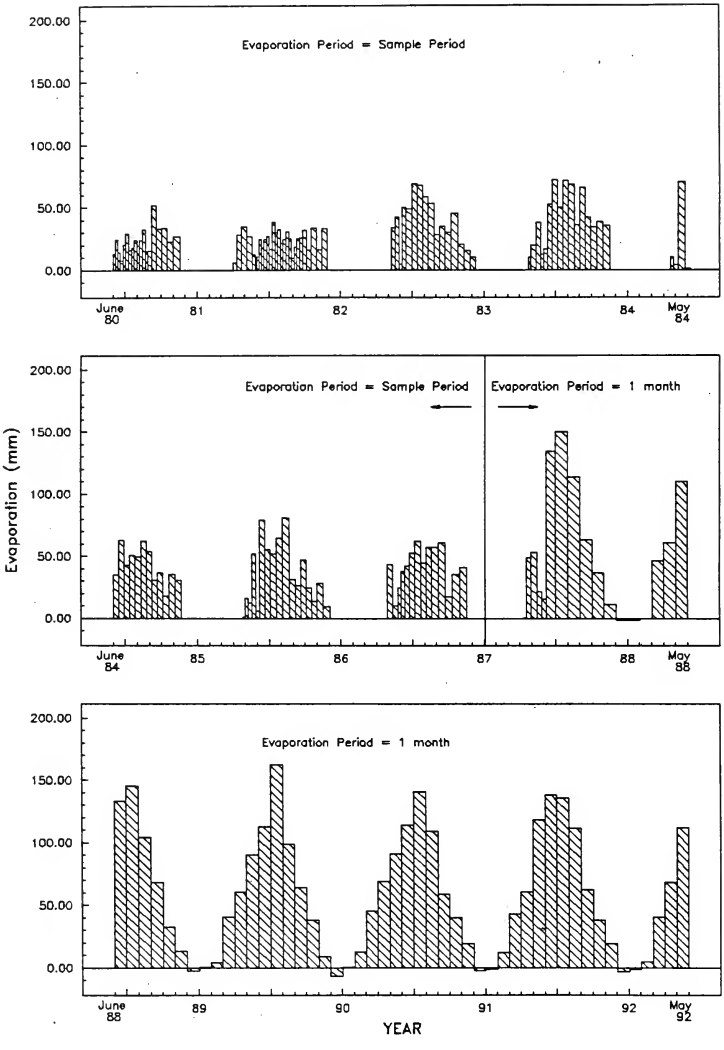


HARP Lake Evaporation

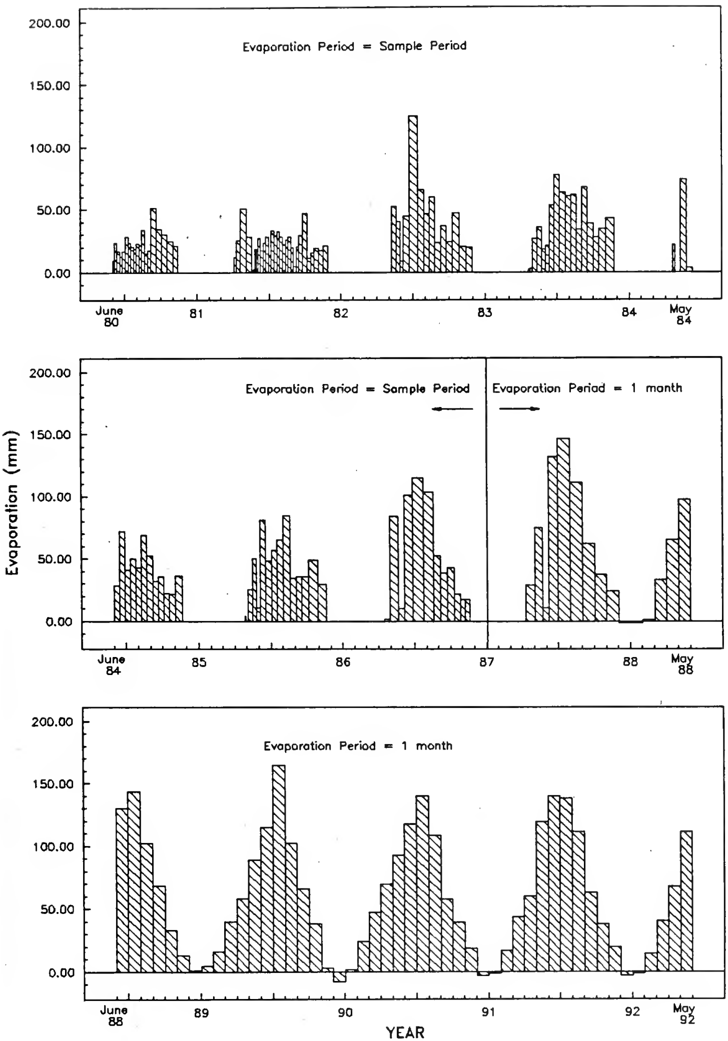



DICKIE Lake Evaporation
Evaporation Period = Sample Period
Evaporation Period = 1 month
Evaporation (mm)
200.00
150.00
100.00
50.00
0.00
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92
YEAR

CROSSON Lake Evaporation



CHUB Lake Evaporation



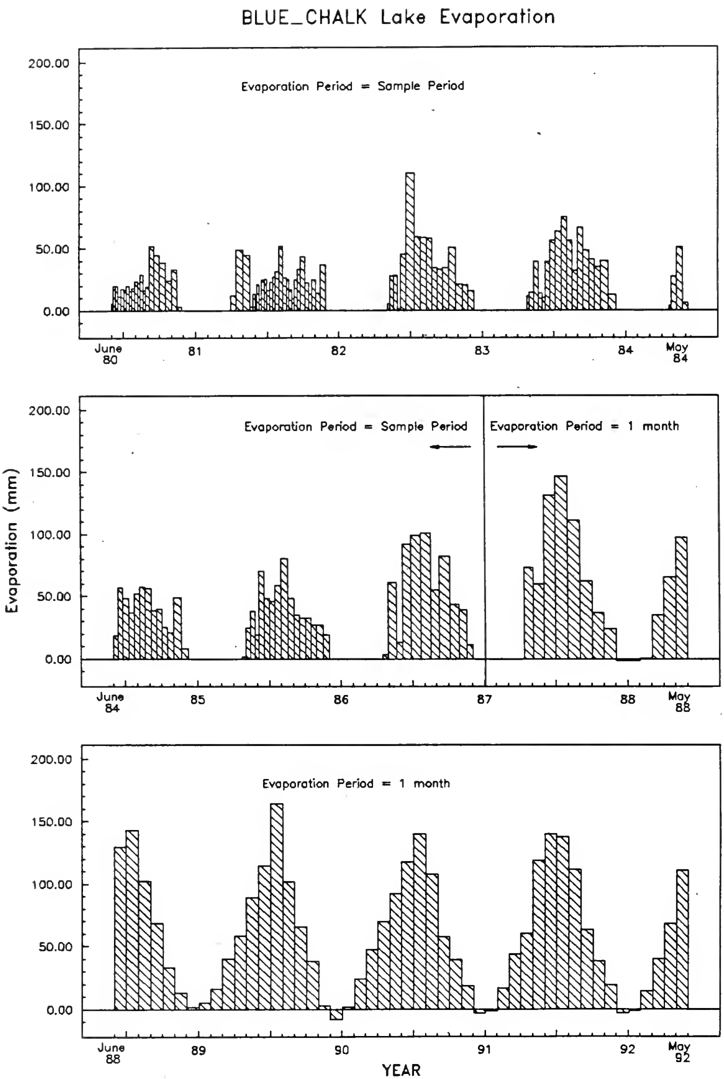

BLUE_CHALK Lake Evaporation
Evaporation Period = Sample Period
Evaporation Period = 1 month
Evaporation (mm)
YEAR
200.00
150.00
100.00
50.00
0.00
June 80
81
82
83
84
May 84
June 84
85
86
87
88
May 88
June 88
89
90
91
92
May 92

Figure 8 Monthly lake evaporation (m/month) for 8 study lakes, 1980-1992.

Blue Chalk
Chub
Crosson
Dickie
Harp
Heney
Plastic
Red Chalk

Figure 7

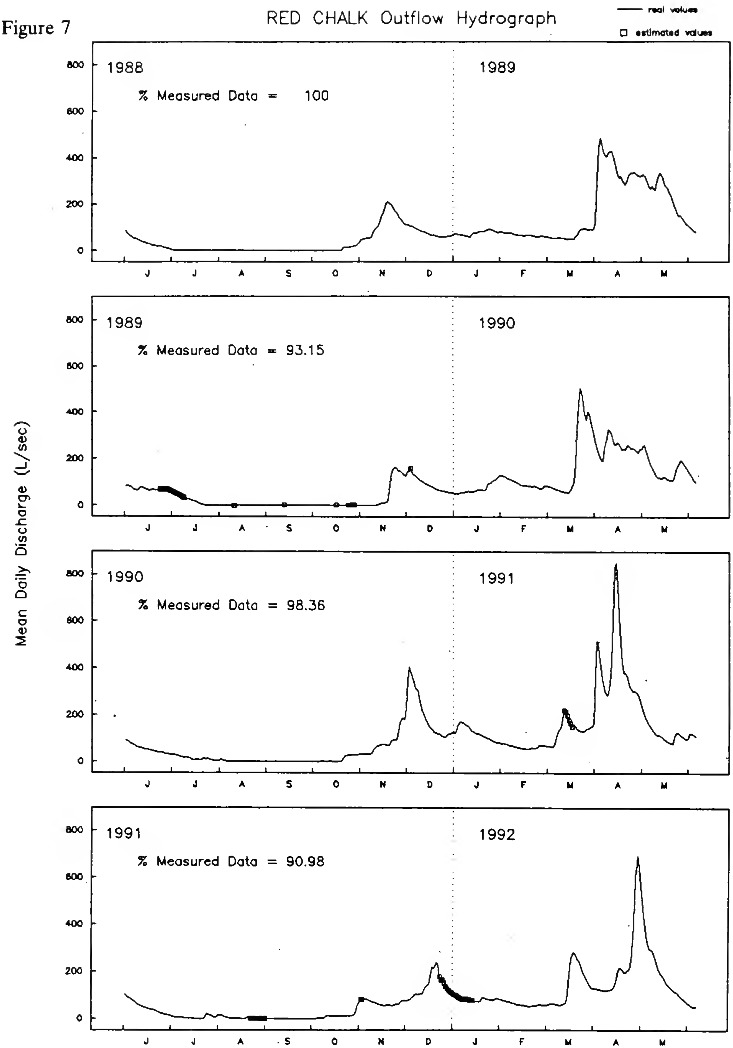

RED CHALK Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 100
1989
1990
% Measured Data = 93.15
1990
1991
% Measured Data = 98.36
1991
1992
% Measured Data = 90.98
800
600
400
200
0
J J A S O N D J F M A M

Figure 7

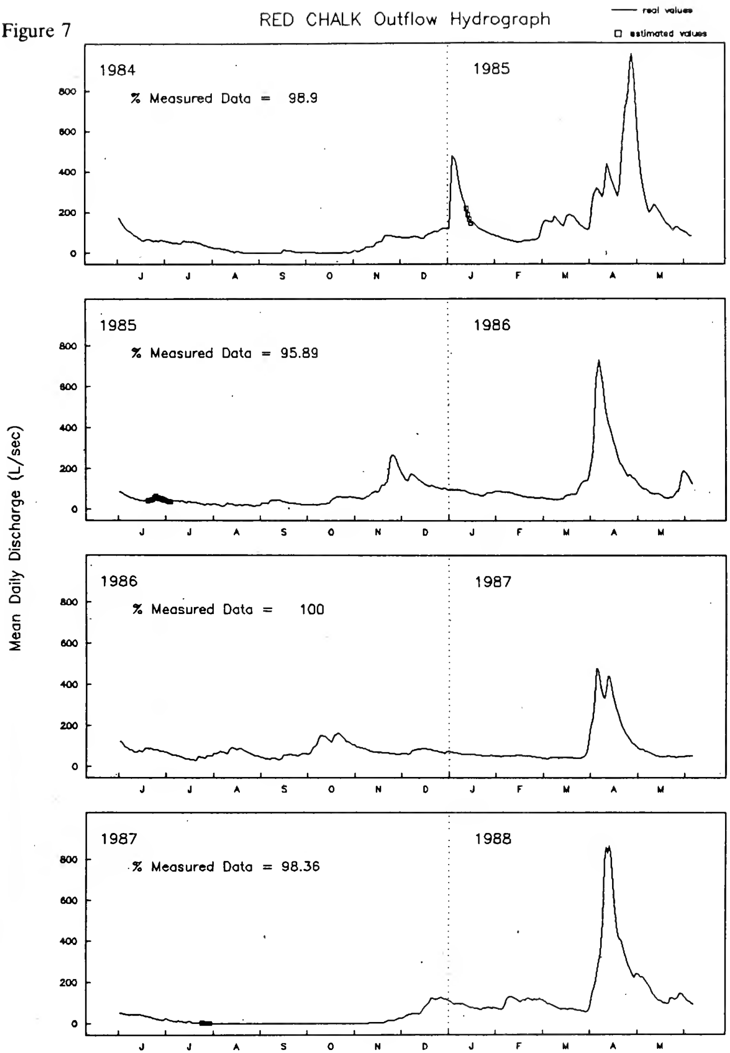

RED CHALK Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 98.9
1985
1986
% Measured Data = 95.89
1986
1987
% Measured Data = 100
1987
1988
% Measured Data = 98.36
0
200
400
600
800
J J A S O N D J F M A M

Figure 7

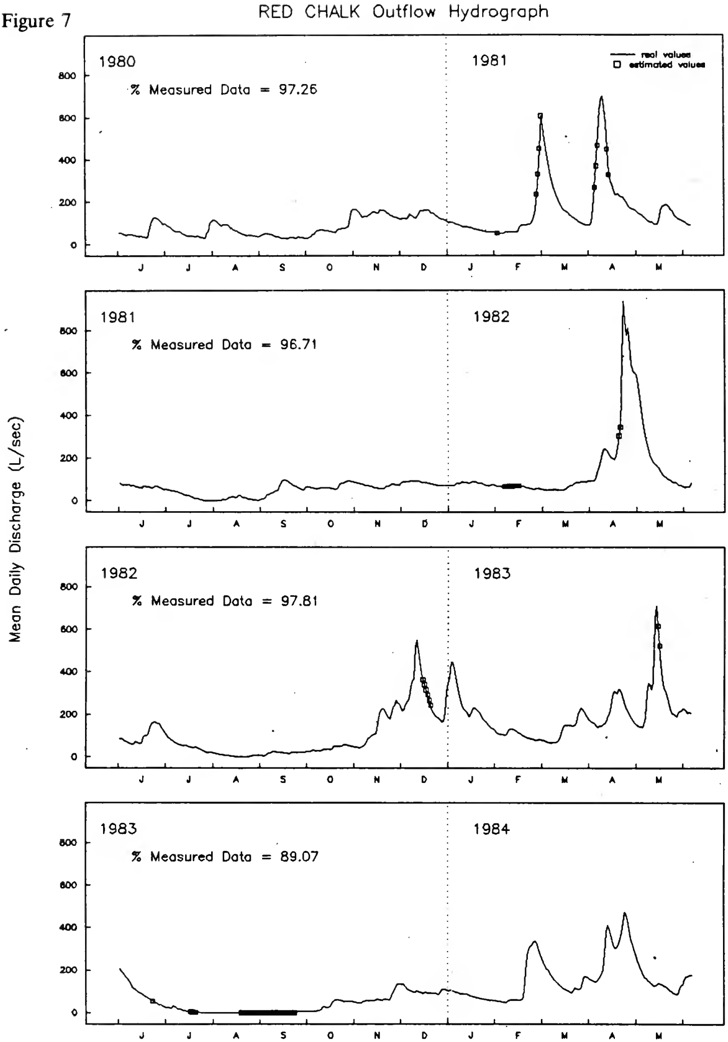

RED CHALK Outflow Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 97.26
1981
1982
% Measured Data = 96.71
1982
1983
% Measured Data = 97.81
1983
1984
% Measured Data = 89.07
0
200
400
600
800
J
J
A
S
O
N
D
J
F
M
A
M

Figure 7

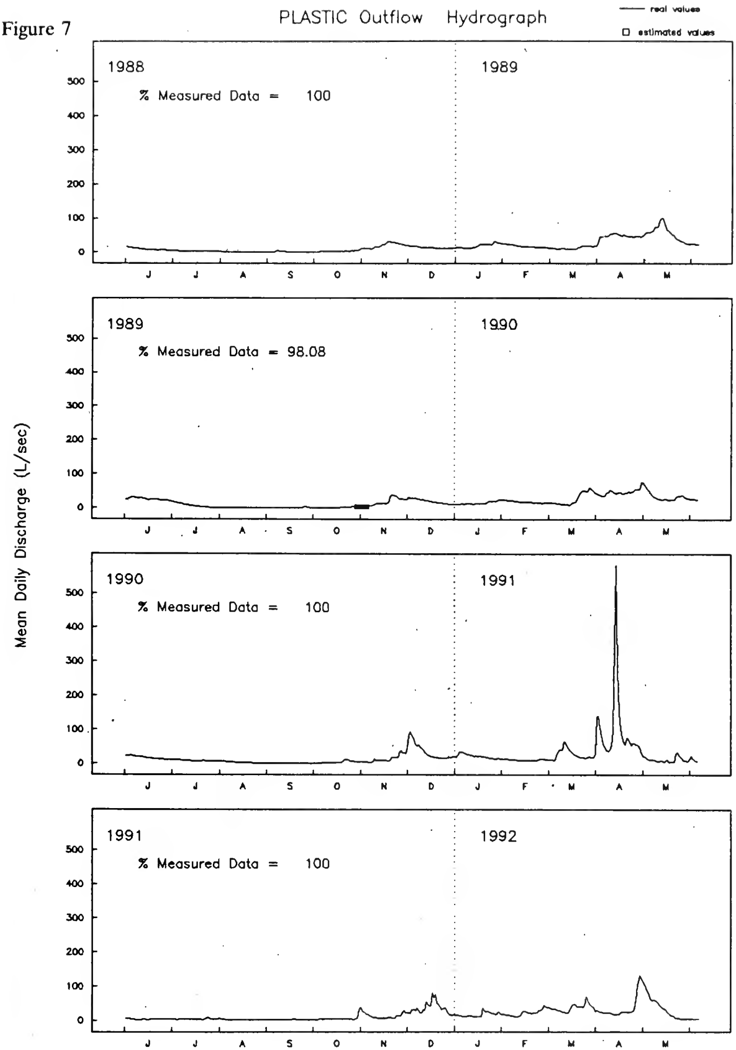

PLASTIC Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 100
1989
1990
% Measured Data = 98.08
1990
1991
% Measured Data = 100
1991
1992
% Measured Data = 100
500
400
300
200
100
0
J J A S O N D J F M A M

Figure 7

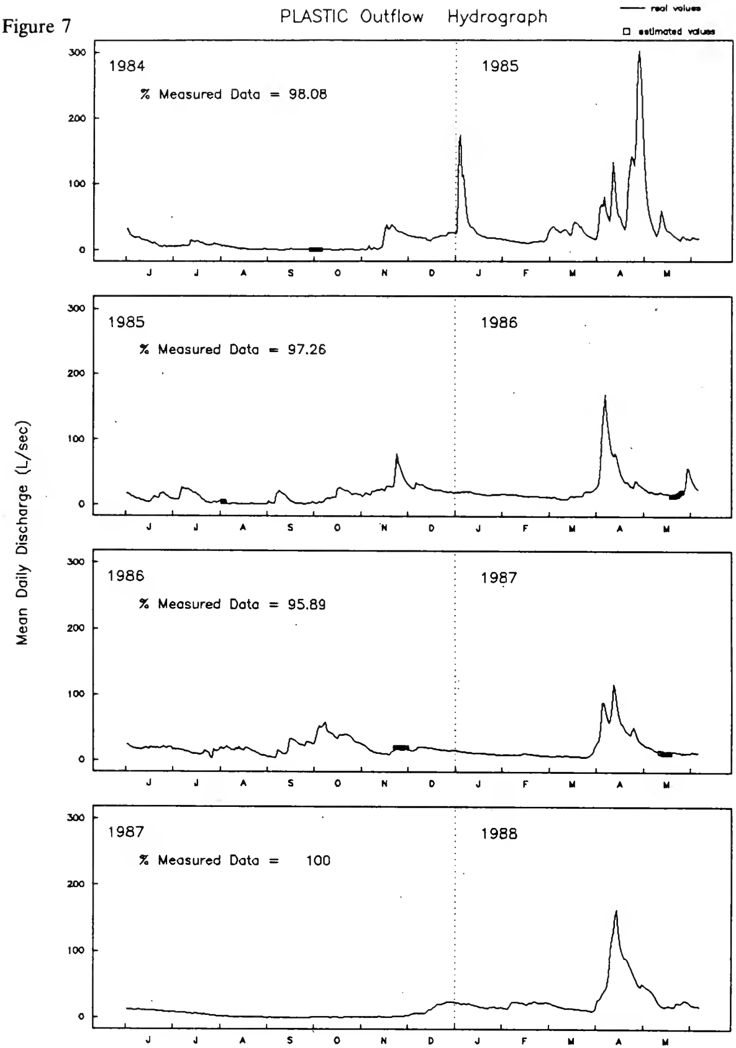

PLASTIC Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 98.08
1985
1986
% Measured Data = 97.26
1986
1987
% Measured Data = 95.89
1987
1988
% Measured Data = 100
0
100
200
300
J J A S O N D J F M A M

Figure 7

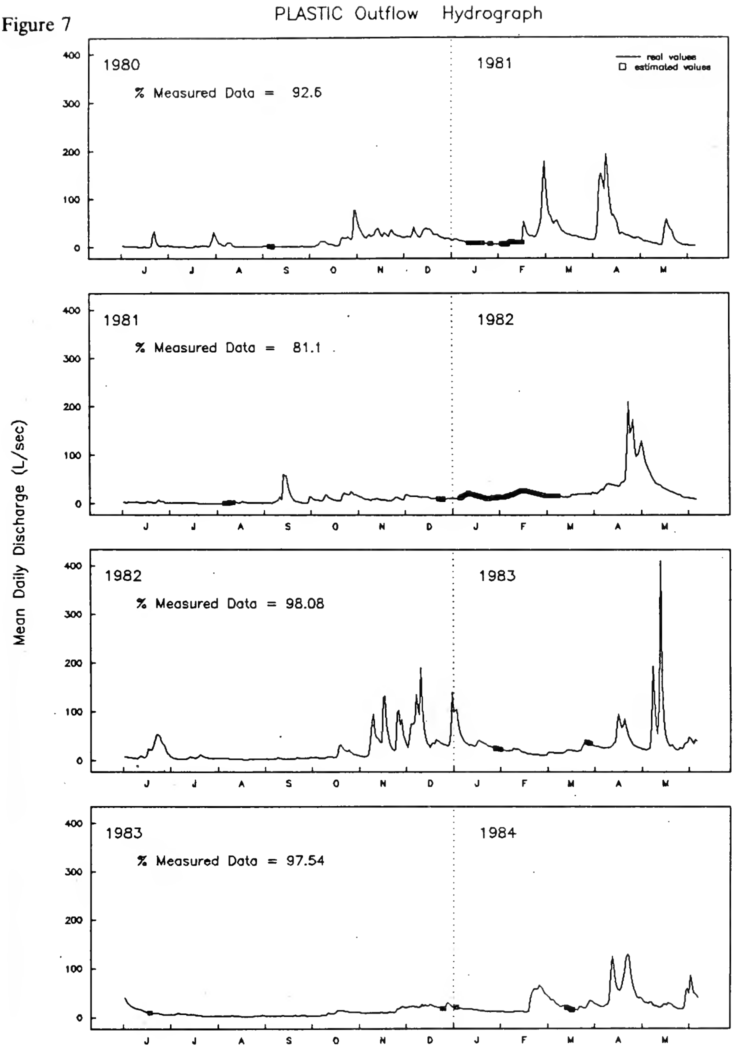
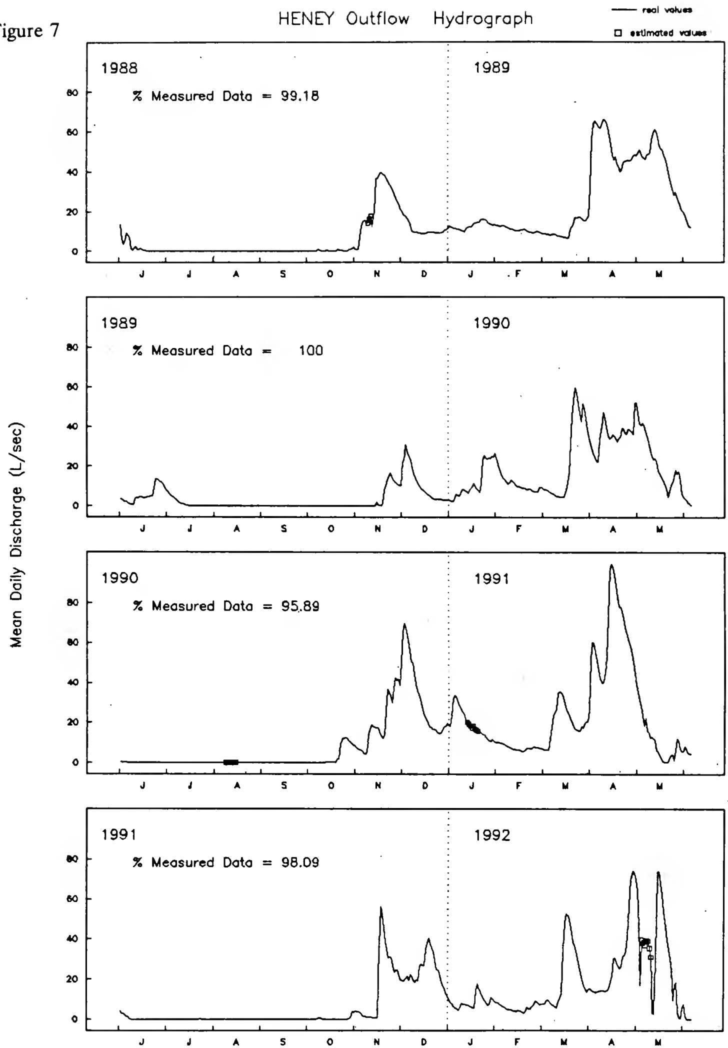
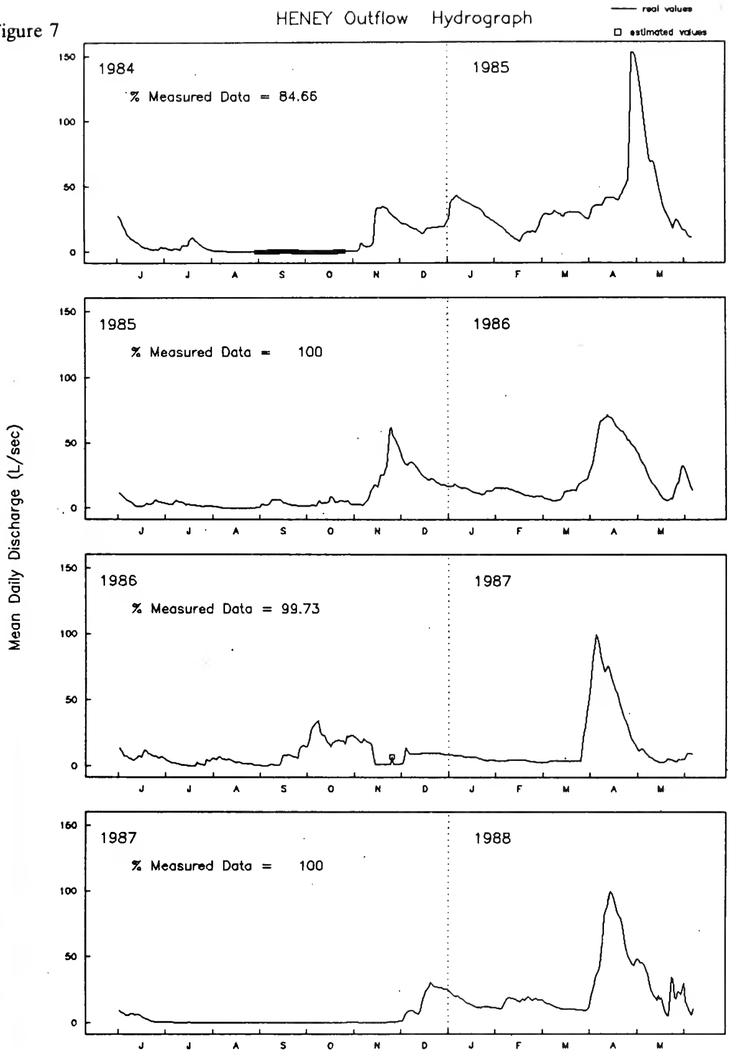

PLASTIC Outflow Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 92.6
1981
1982
% Measured Data = 81.1
1982
1983
% Measured Data = 98.08
1983
1984
% Measured Data = 97.54
0
100
200
300
400
J J A S O N D J F M A M

Figure 7



HENEY Outflow Hydrograph
real values
estimated values
1988
1989
% Measured Data = 99.18
1989
1990
% Measured Data = 100
1990
1991
% Measured Data = 95.89
1991
1992
% Measured Data = 98.09
Mean Daily Discharge (L/sec)
J J A S O N D J F M A M

Figure 7



HENEY Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 84.66
1985
1986
% Measured Data = 100
1986
1987
% Measured Data = 99.73
1987
1988
% Measured Data = 100
150
100
50
0
J J A S O N D J F M A M

Figure 7

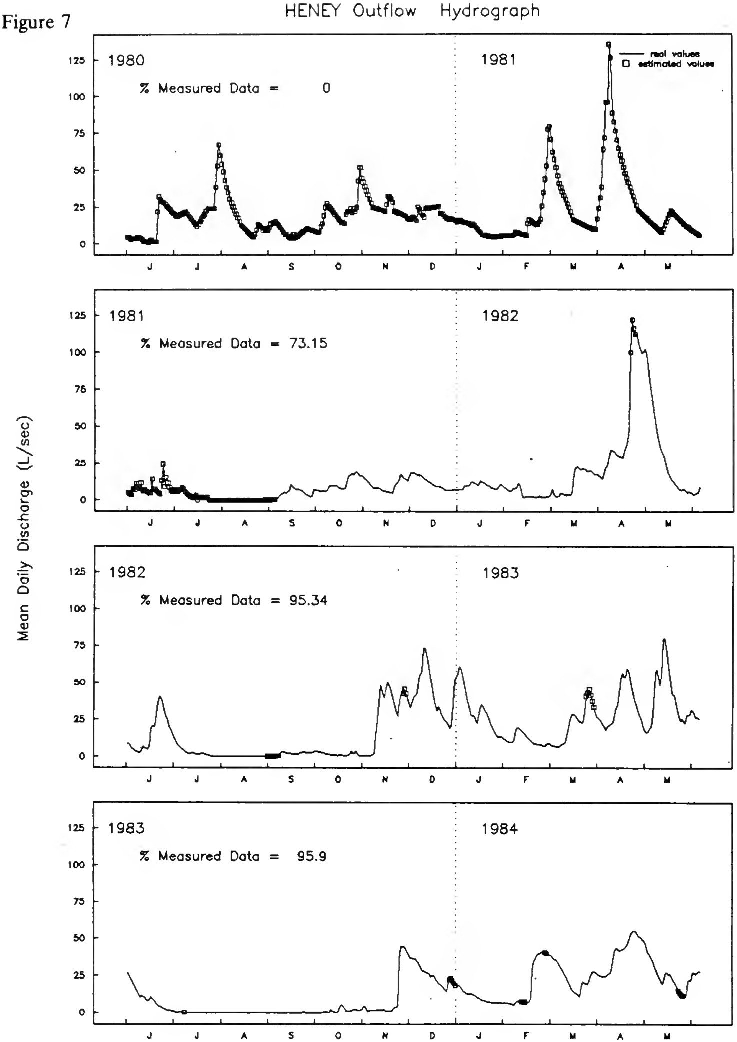

HENEY Outflow Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 0
1981
1982
% Measured Data = 73.15
1982
1983
% Measured Data = 95.34
1983
1984
% Measured Data = 95.9
0
25
50
75
100
125
J J A S O N D J F M A M

Figure 7

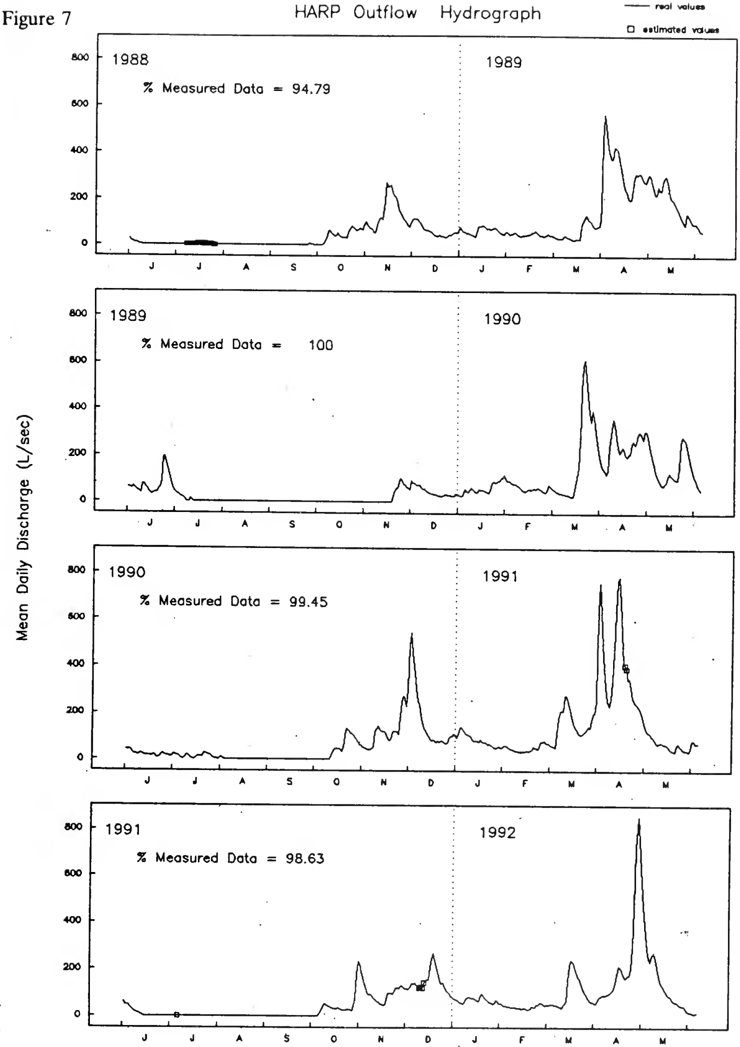

HARP Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 94.79
1989
1990
% Measured Data = 100
1990
1991
% Measured Data = 99.45
1991
1992
% Measured Data = 98.63
0
200
400
600
800
J J A S O N D J F M A M

Figure 7

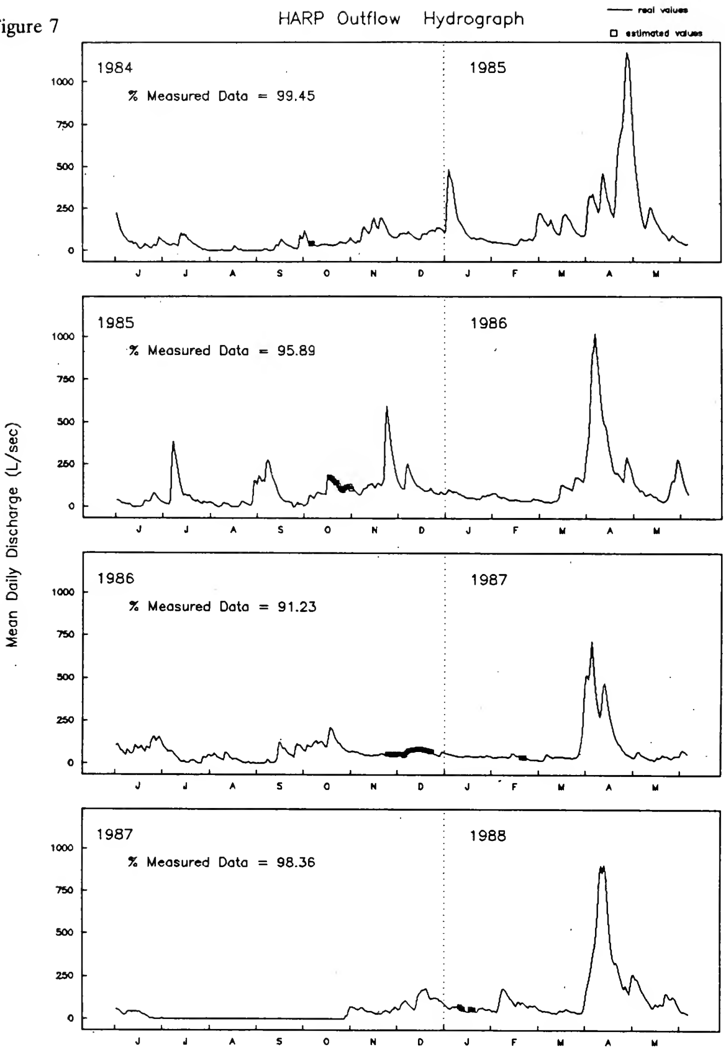
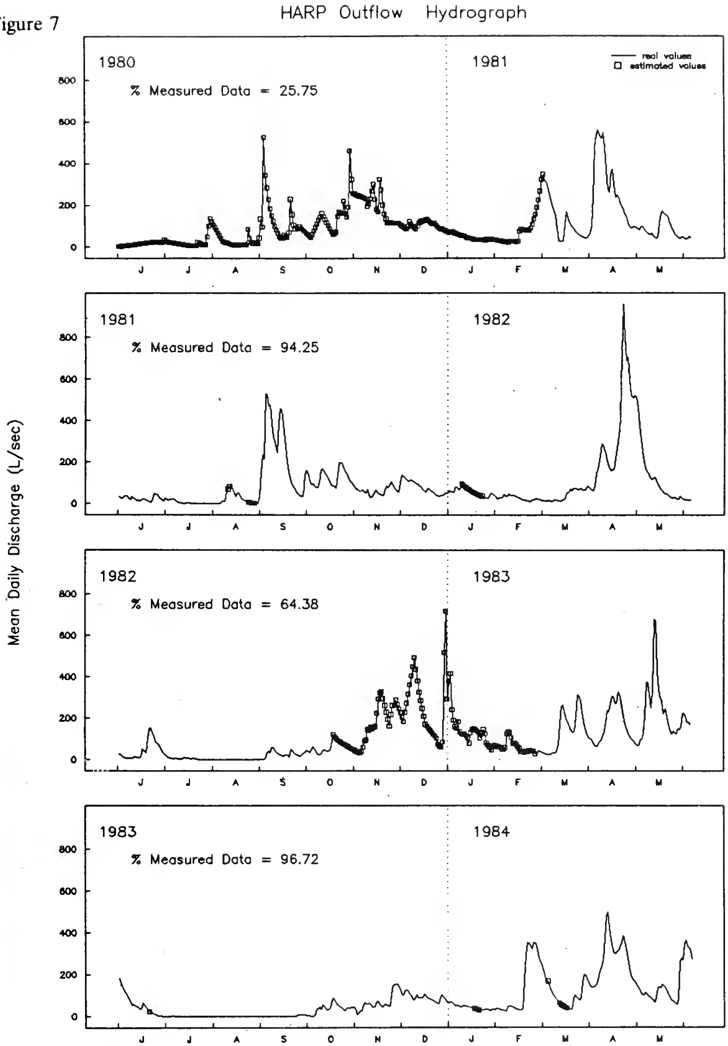

HARP Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 99.45
1985
1986
% Measured Data = 95.89
1986
1987
% Measured Data = 91.23
1987
1988
% Measured Data = 98.36
1000
750
500
250
0
J J A S O N D J F M A M

Figure 7



HARP Outflow Hydrograph
real values
estimated values
1980
1981
% Measured Data = 25.75
1981
1982
% Measured Data = 94.25
1982
1983
% Measured Data = 64.38
1983
1984
% Measured Data = 96.72
Mean Daily Discharge (L/sec)
0
200
400
600
800
J J A S O N D J F M A M

Figure 7

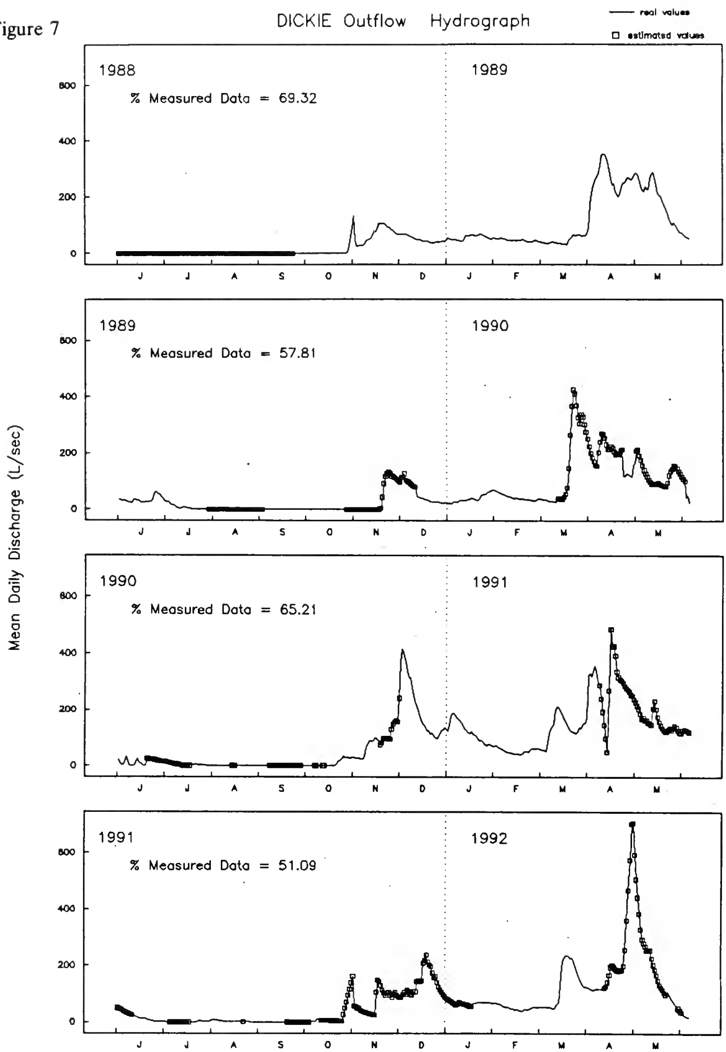

DICKIE Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 69.32
1989
1990
% Measured Data = 57.81
1990
1991
% Measured Data = 65.21
1991
1992
% Measured Data = 51.09
0
200
400
600
J J A S O N D J F M A M

Figure 7

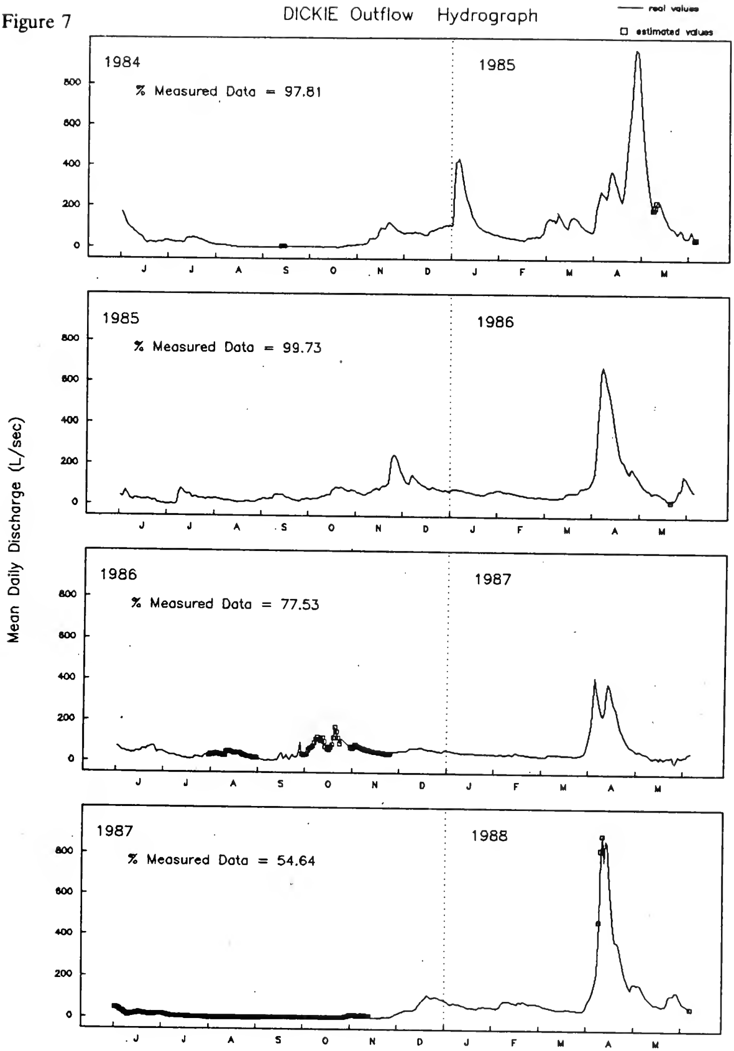

DICKIE Outflow Hydrograph
real values
estimated values
1984
1985
% Measured Data = 97.81
1985
1986
% Measured Data = 99.73
1986
1987
% Measured Data = 77.53
1987
1988
% Measured Data = 54.64
Mean Daily Discharge (L/sec)
0
200
400
600
800
J
J
A
S
O
N
D
J
F
M
A
M

Figure 7

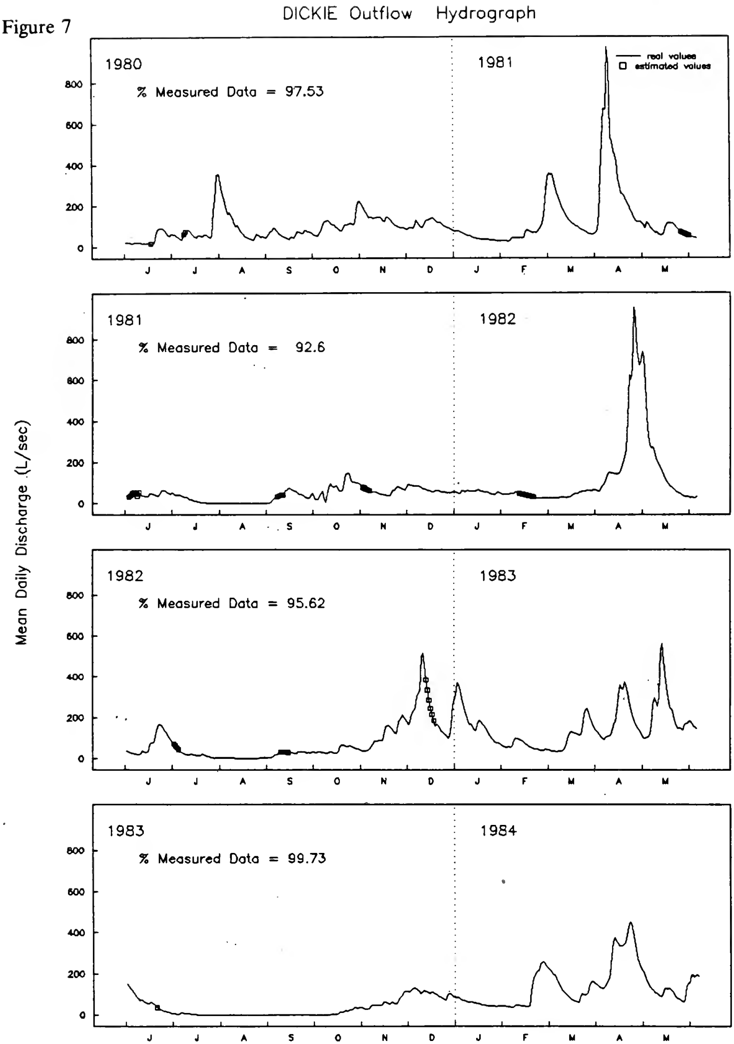

DICKIE Outflow Hydrograph
1980
1981
% Measured Data = 97.53
real values
estimated values
1981
1982
% Measured Data = 92.6
1982
1983
% Measured Data = 95.62
1983
1984
% Measured Data = 99.73
Mean Daily Discharge (L/sec)
800
600
400
200
0
J J A S O N D J F M A M

Figure 7

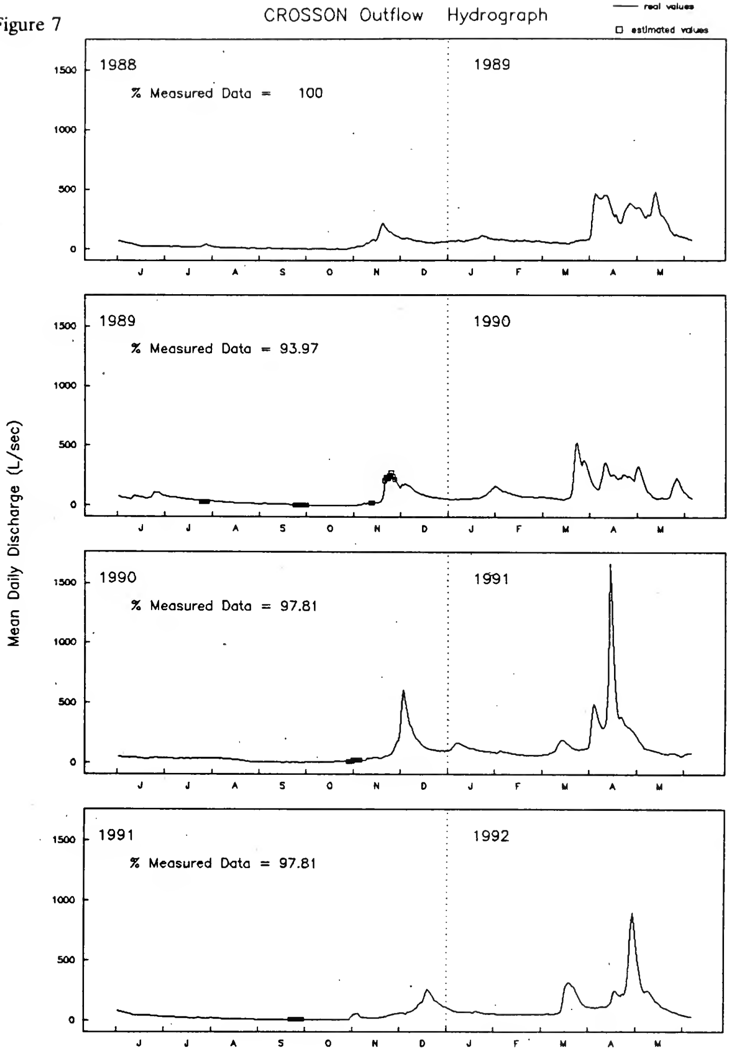

CROSSON Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 100
1989
1990
% Measured Data = 93.97
1990
1991
% Measured Data = 97.81
1991
1992
% Measured Data = 97.81
1500
1000
500
0
J J A S O N D J F M A M

Figure 7

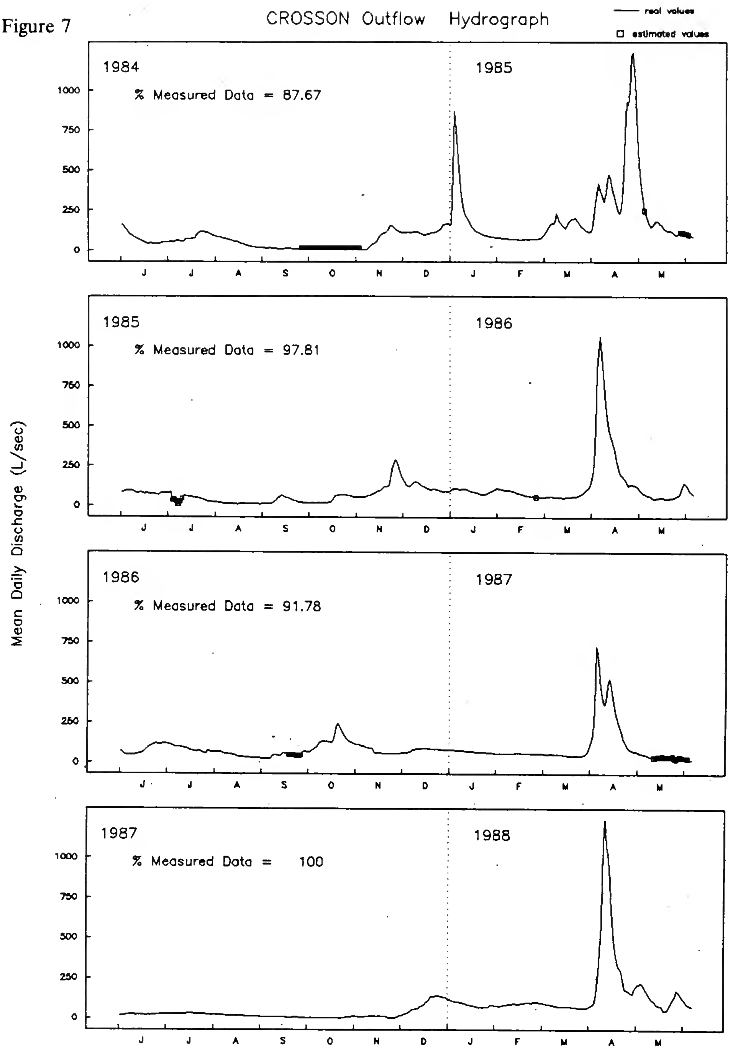

CROSSON Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 87.67
1985
1986
% Measured Data = 97.81
1986
1987
% Measured Data = 91.78
1987
1988
% Measured Data = 100
0
250
500
750
1000
J J A S O N D J F M A M

Figure 7

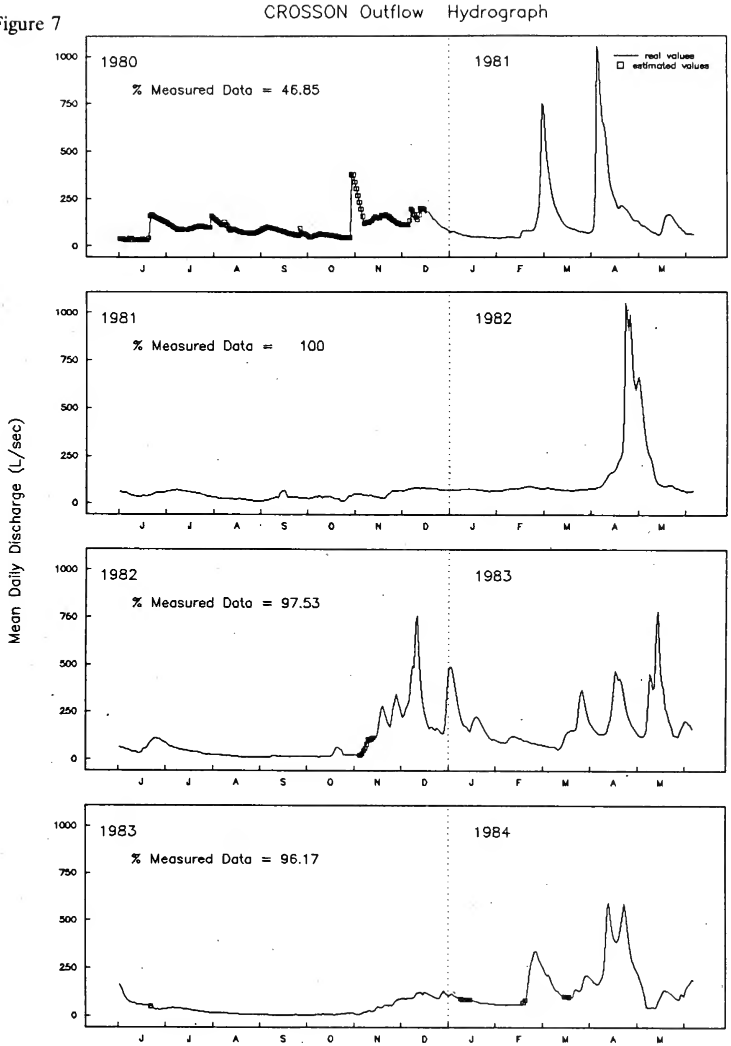

CROSSON Outflow Hydrograph
Mean Daily Discharge (L/sec)
1980
1981
% Measured Data = 46.85
real values
estimated values
1981
1982
% Measured Data = 100
1982
1983
% Measured Data = 97.53
1983
1984
% Measured Data = 96.17
1000
750
500
250
0
J J A S O N D J F M A M

Figure 7

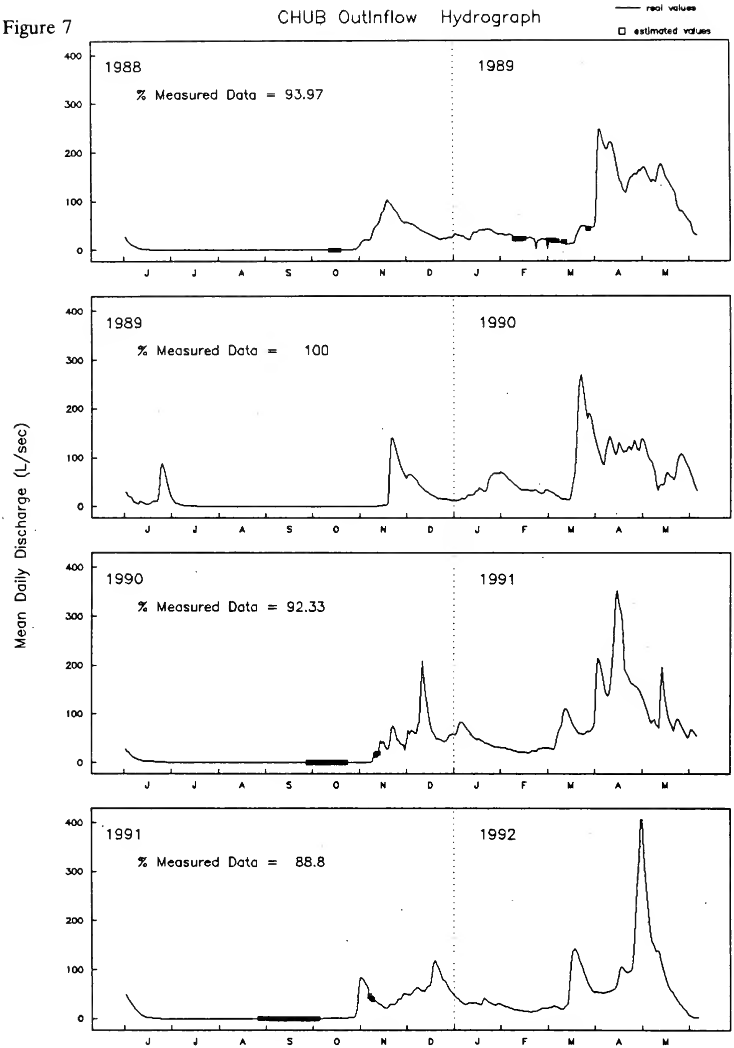

CHUB OutInflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 93.97
1989
1990
% Measured Data = 100
1990
1991
% Measured Data = 92.33
1991
1992
% Measured Data = 88.8
0
100
200
300
400
J J A S O N D J F M A M

Figure 7

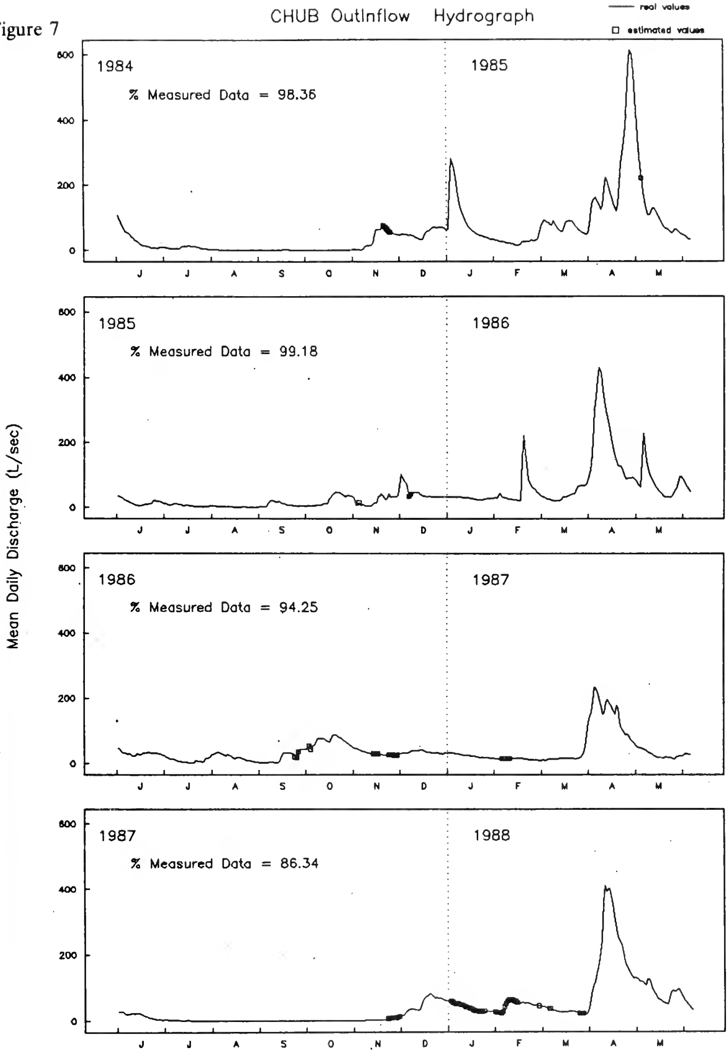

CHUB OutInflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 98.36
1985
1986
% Measured Data = 99.18
1986
1987
% Measured Data = 94.25
1987
1988
% Measured Data = 86.34
0
200
400
600
J J A S O N D J F M A M

Figure 7

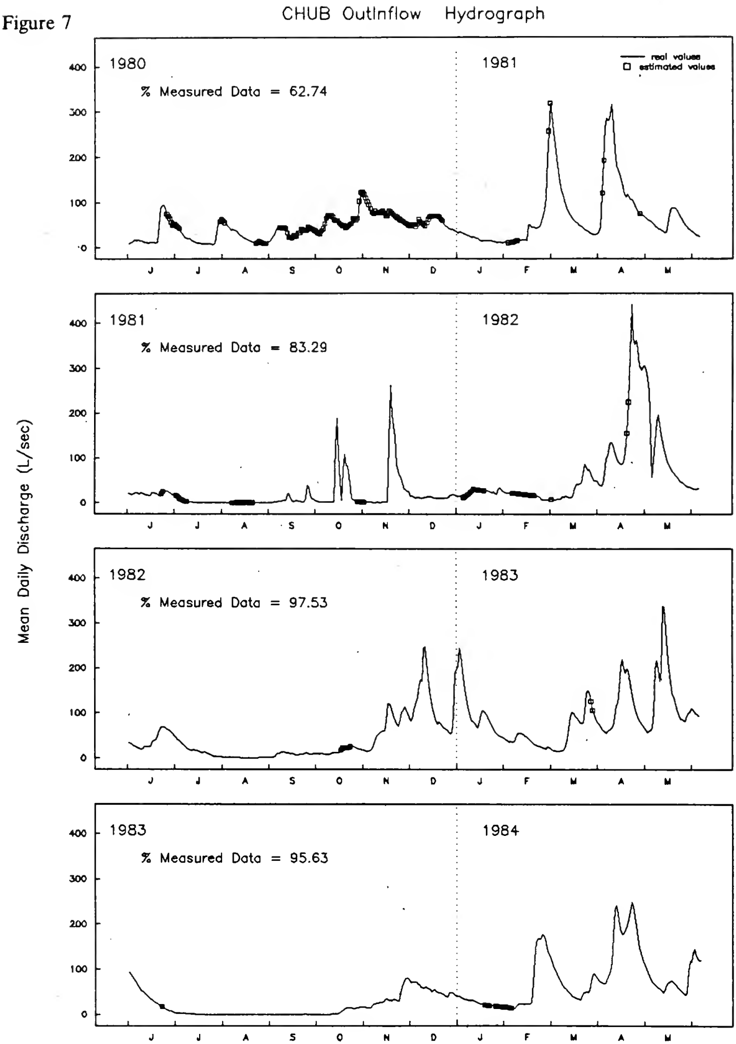
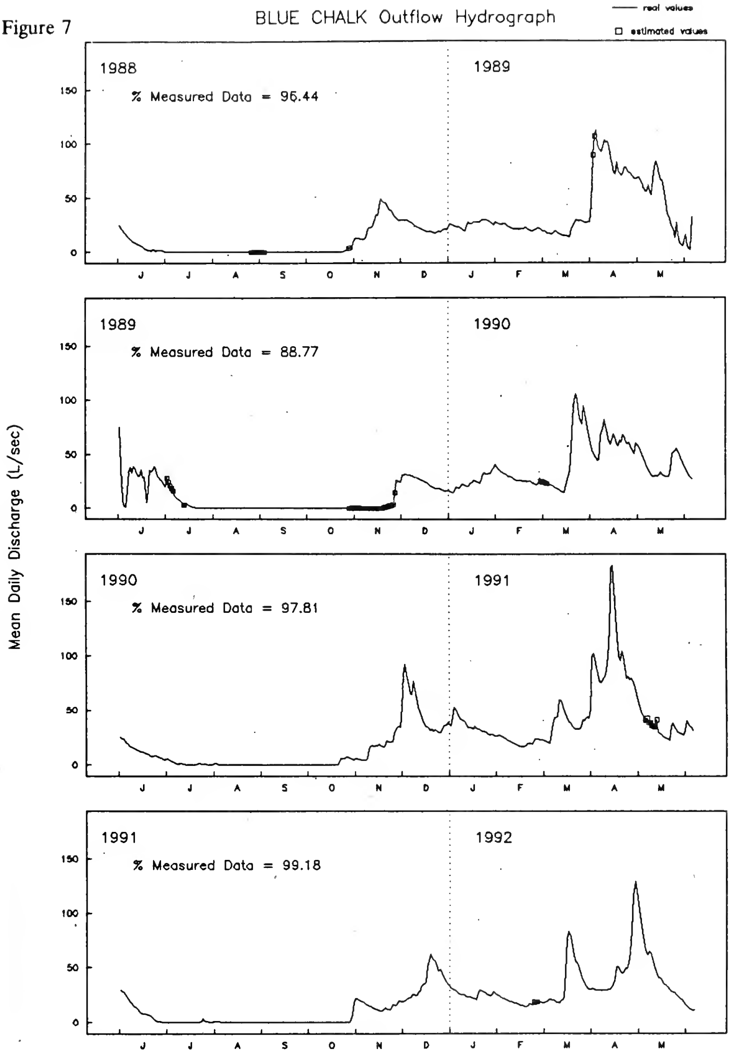

CHUB Outlnflow Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 62.74
1981
1982
% Measured Data = 83.29
1982
1983
% Measured Data = 97.53
1983
1984
% Measured Data = 95.63
0
100
200
300
400
J J A S O N D J F M A M

Figure 7



BLUE CHALK Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 96.44
1989
1990
% Measured Data = 88.77
1990
1991
% Measured Data = 97.81
1991
1992
% Measured Data = 99.18
0
50
100
150
J J A S O N D J F M A M

Figure 7

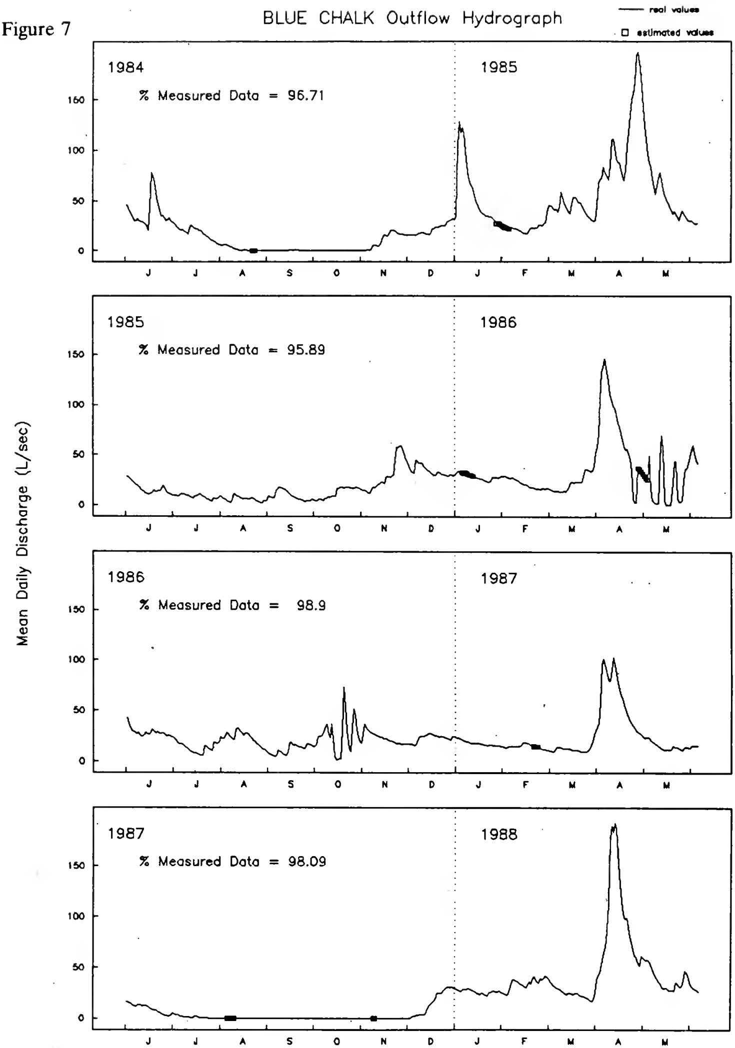
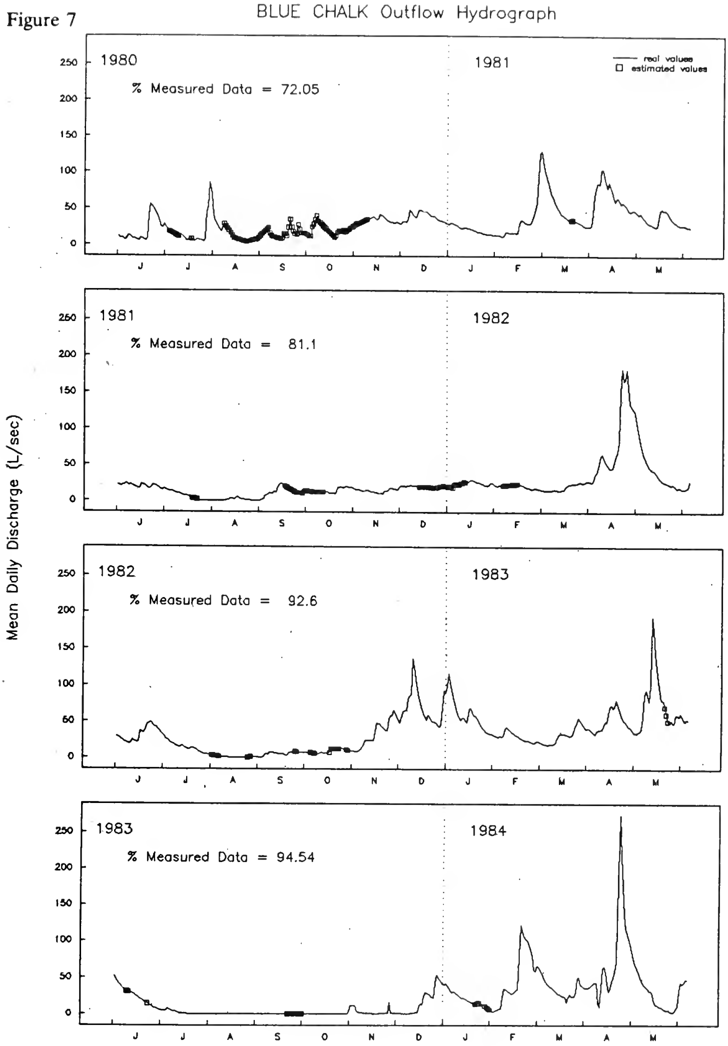

BLUE CHALK Outflow Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 96.71
1985
1986
% Measured Data = 95.89
1986
1987
% Measured Data = 98.9
1987
1988
% Measured Data = 98.09
0
50
100
150
J J A S O N D J F M A M

Figure 7



BLUE CHALK Outflow Hydrograph
Mean Daily Discharge (L/sec)
1980
1981
% Measured Data = 72.05
real values
estimated values
1981
1982
% Measured Data = 81.1
1982
1983
% Measured Data = 92.6
1983
1984
% Measured Data = 94.54
J J A S O N D J F M A M

Figure 7 Mean daily discharge (L/sec) for 8 outlet streams, 1980-1992.

Blue Chalk	(1980-1984)
	(1984-1988)
	(1988-1992)
Chub	(1980-1984)
	(1984-1988)
	(1988-1992)
Crosson	(1980-1984)
	(1984-1988)
	(1988-1992)
Dickie	(1980-1984)
	(1984-1988)
	(1988-1992)
Harp	(1980-1984)
	(1984-1988)
	(1988-1992)
Heney	(1980-1984)
	(1984-1988)
	(1988-1992)
Plastic	(1980-1984)
	(1984-1988)
	(1988-1992)
Red Chalk	(1980-1984)
	(1984-1988)
	(1988-1992)

Figure 6

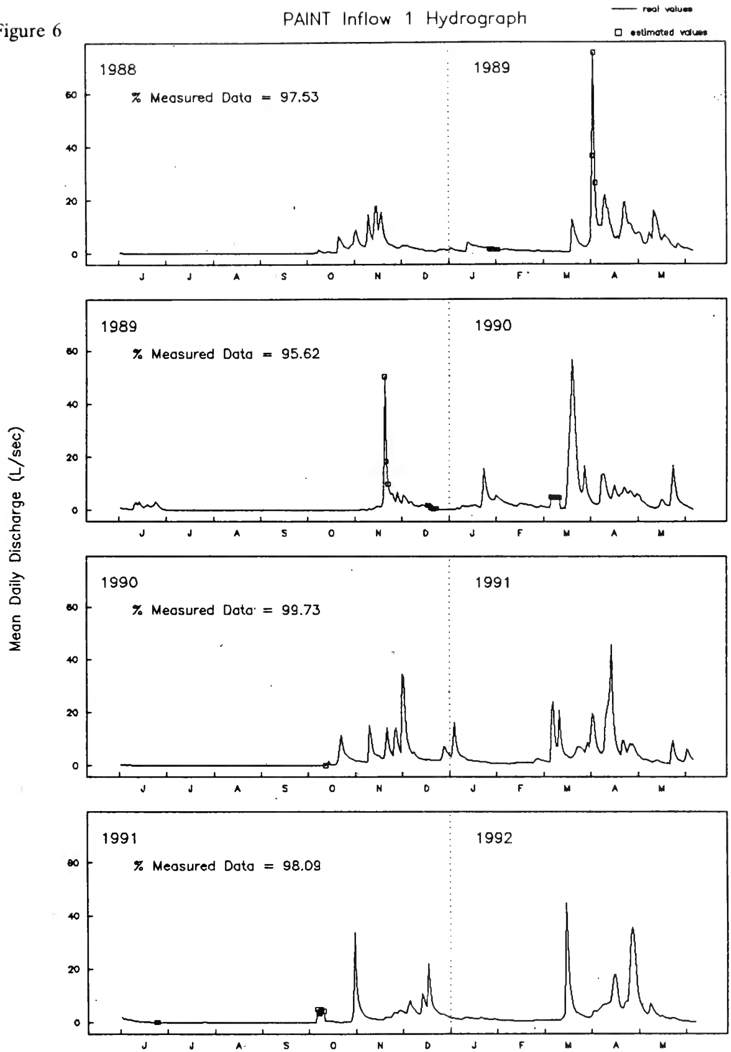
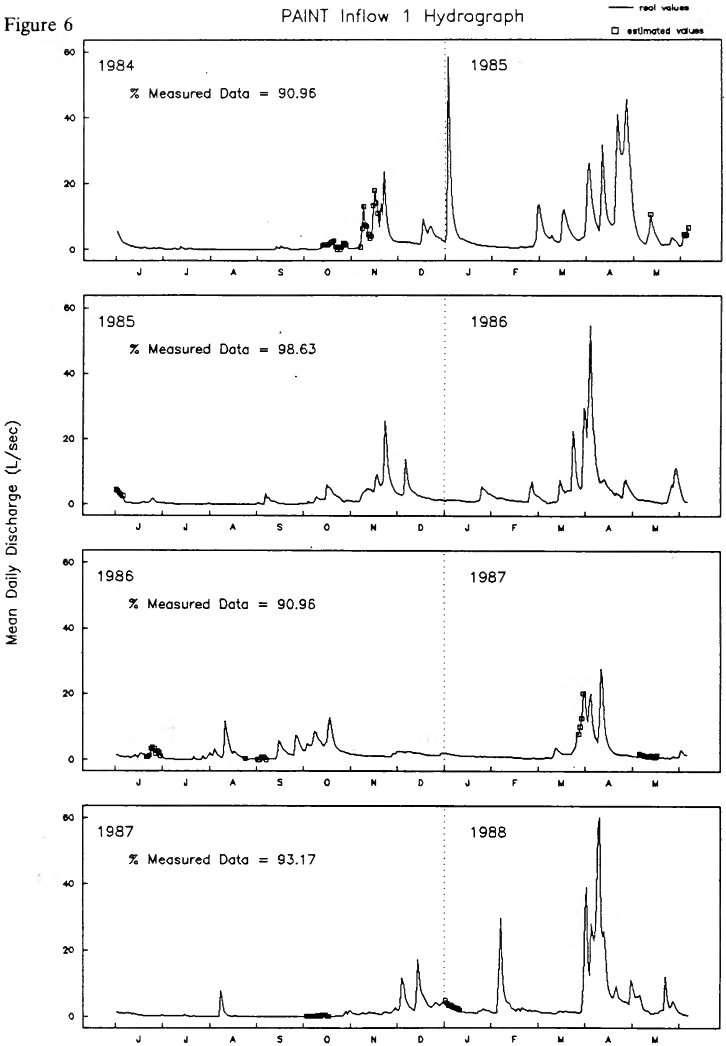

PAINT Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 97.53
1989
1990
% Measured Data = 95.62
1990
1991
% Measured Data = 99.73
1991
1992
% Measured Data = 98.09
0
20
40
60
J J A S O N D J F M A M

Figure 6



PAINT Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 90.96
1985
1986
% Measured Data = 98.63
1986
1987
% Measured Data = 90.96
1987
1988
% Measured Data = 93.17
0
20
40
60
J J A S O N D J F M A M

PAINT Inflow 1 Hydrograph

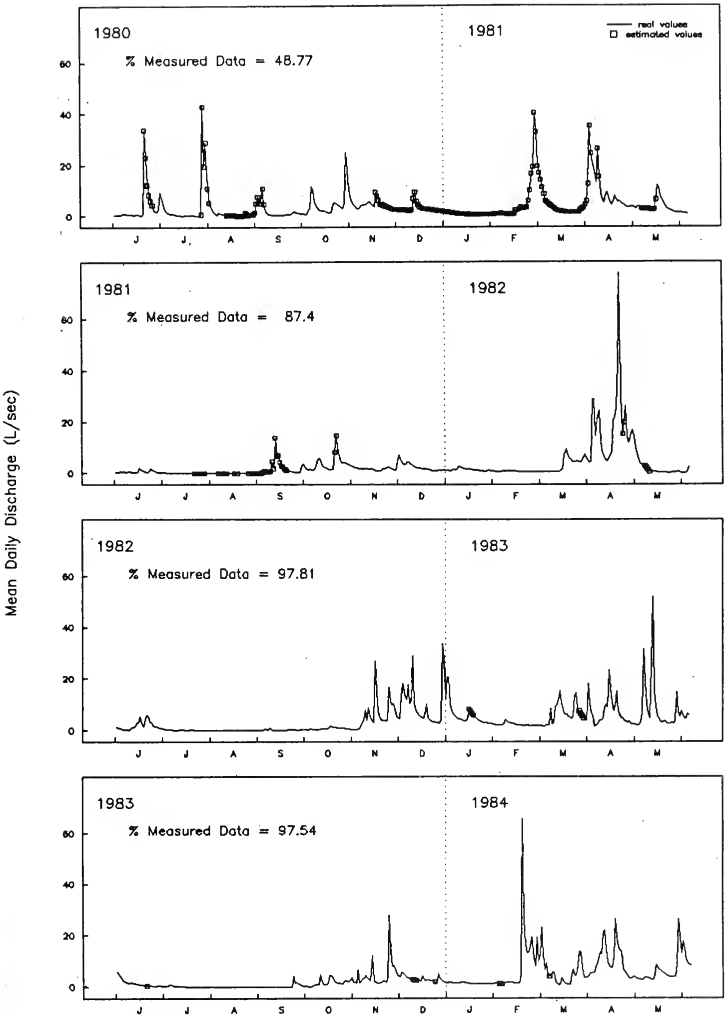


Figure 6

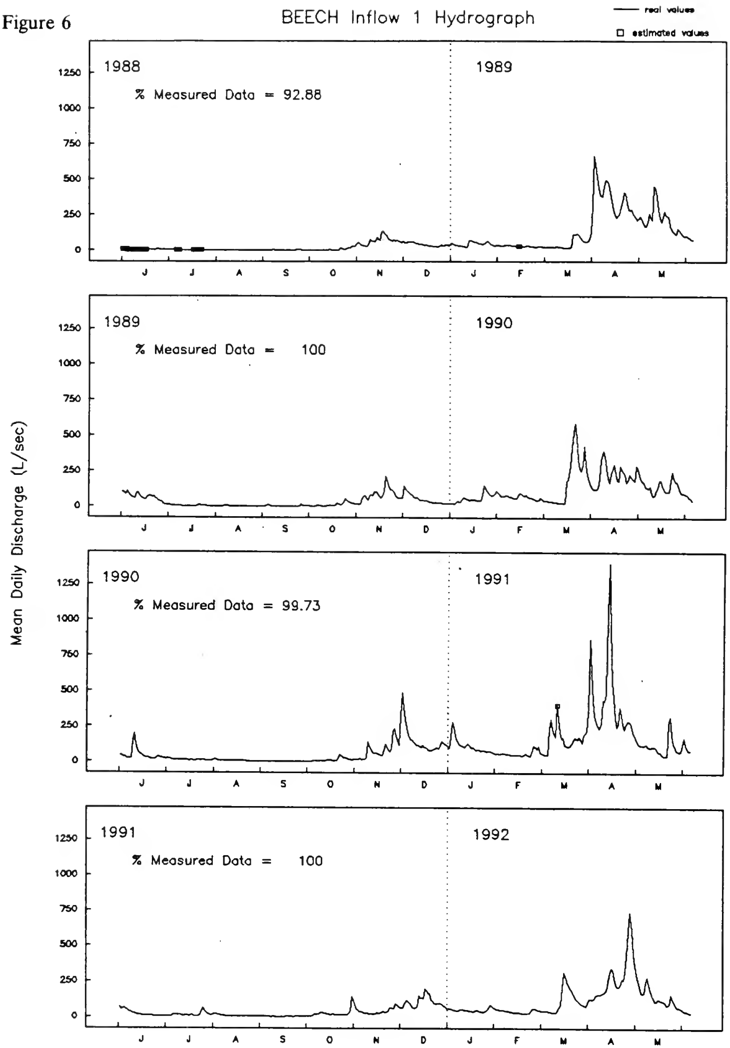
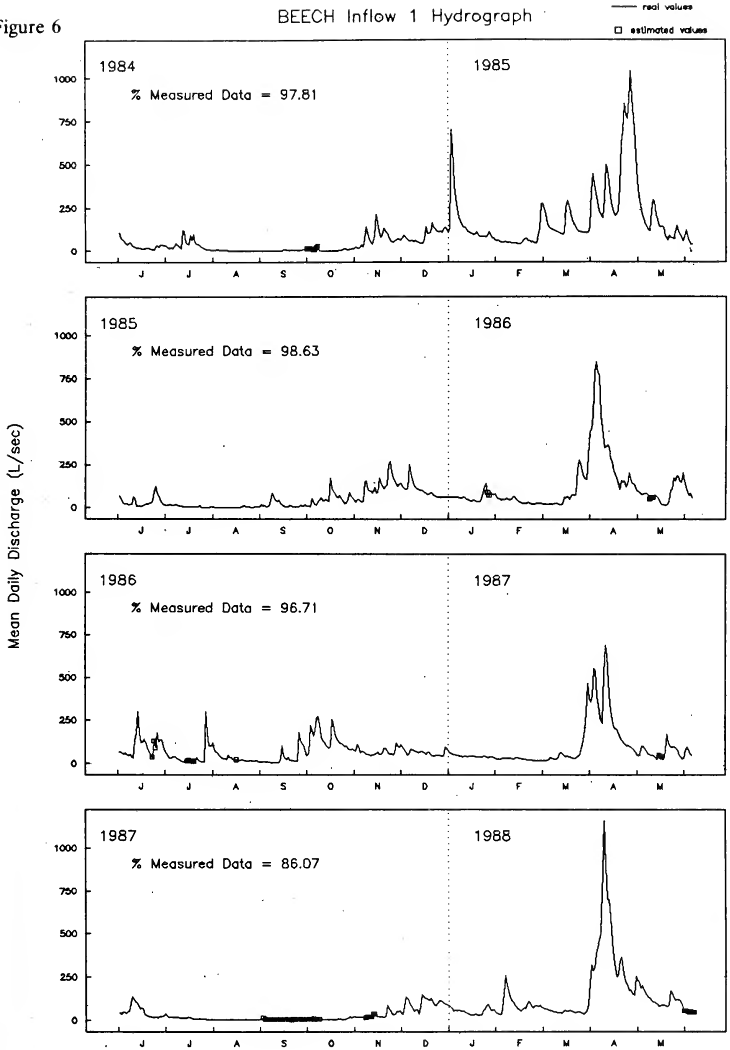

BEECH Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 92.88
1989
1990
% Measured Data = 100
1990
1991
% Measured Data = 99.73
1991
1992
% Measured Data = 100
1250
1000
750
500
250
0
J J A S O N D J F M A M

Figure 6



BEECH Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 97.81
1985
1986
% Measured Data = 98.63
1986
1987
% Measured Data = 96.71
1987
1988
% Measured Data = 86.07
1000
750
500
250
0
J J A S O N D J F M A M

Figure 6

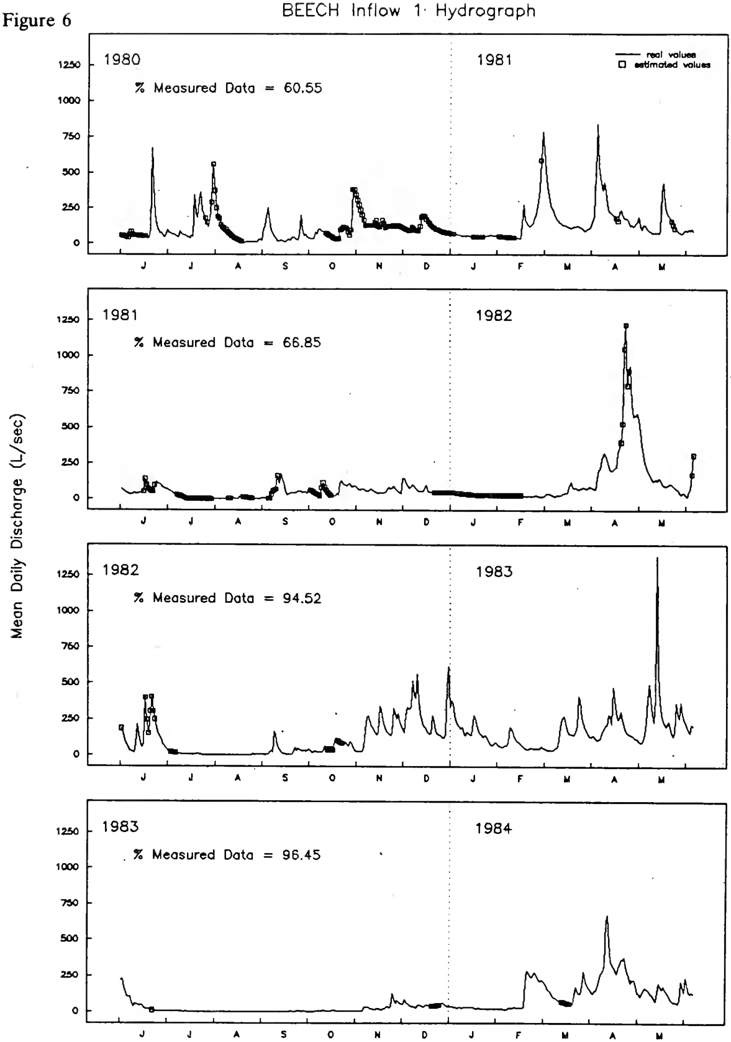

BEECH Inflow 1· Hydrograph
1980
1981
real values
estimated values
% Measured Data = 60.55
1981
1982
% Measured Data = 66.85
1982
1983
% Measured Data = 94.52
1983
1984
% Measured Data = 96.45
Mean Daily Discharge (L/sec)
0
250
500
750
1000
1250
J J A S O N D J F M A M

Figure 6

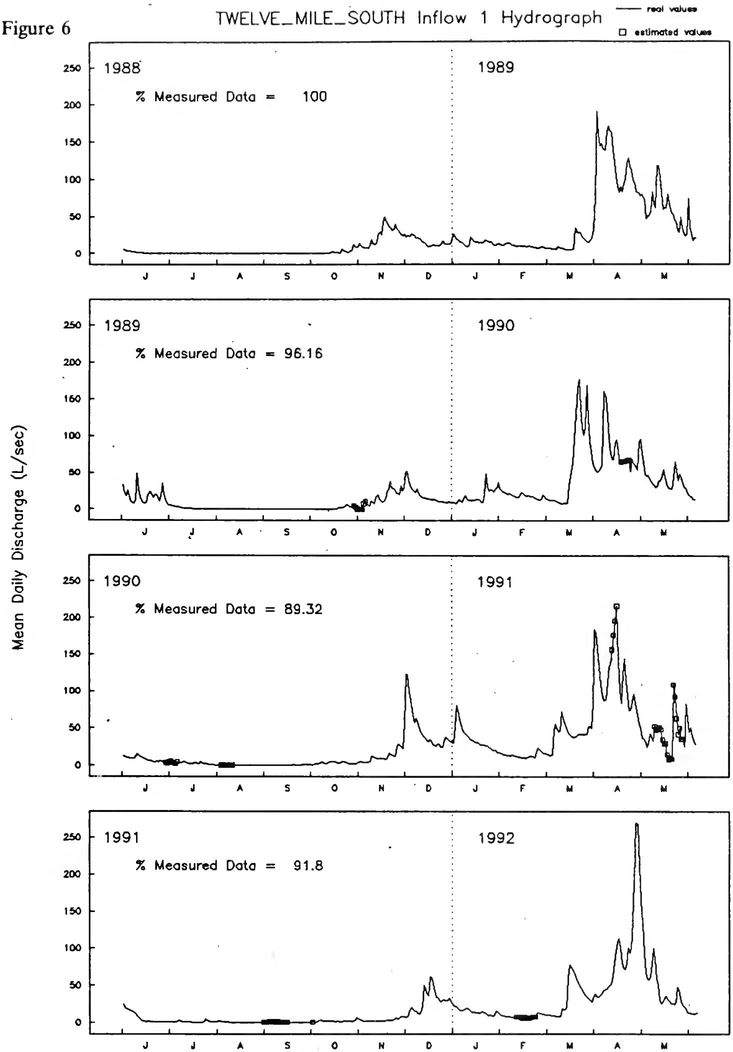
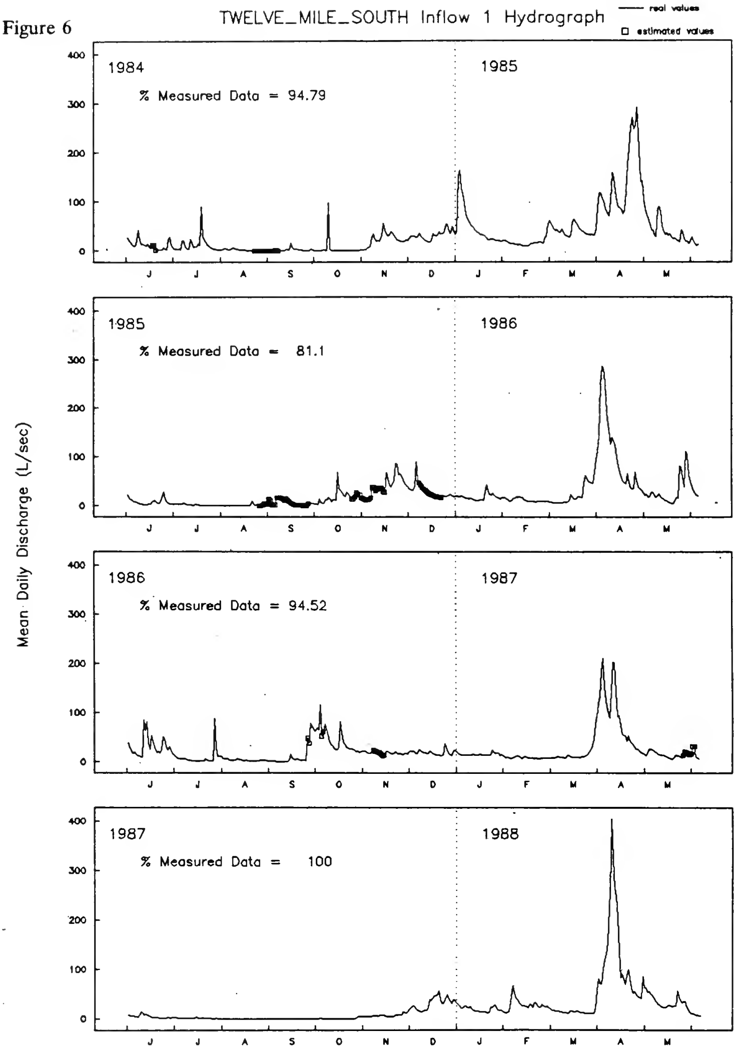

TWELVE_MILE_SOUTH Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 100
1989
1990
% Measured Data = 96.16
1990
1991
% Measured Data = 89.32
1991
1992
% Measured Data = 91.8
0
50
100
150
200
250
J
J
A
S
O
N
D
J
F
M
A
M

Figure 6


TWELVE_MILE_SOUTH Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 94.79
1985
1986
% Measured Data = 81.1
1986
1987
% Measured Data = 94.52
1987
1988
% Measured Data = 100
0
100
200
300
400
J J A S O N D J F M A M

TWELVE_MILE_South Inflow 1 Hydrograph

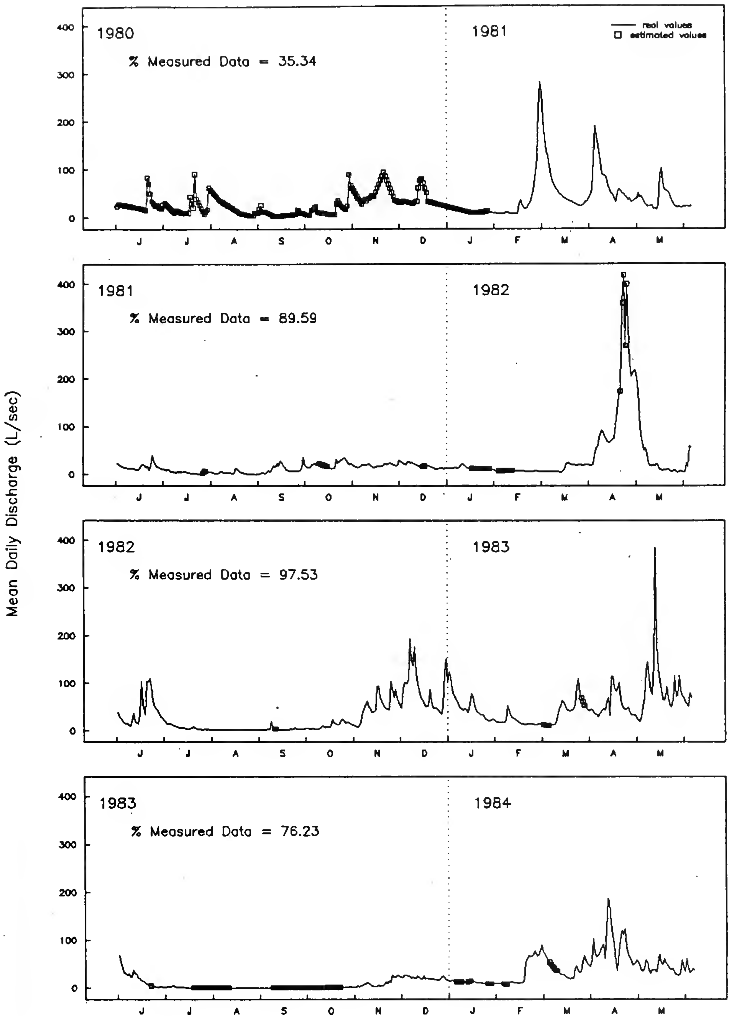


Figure 6

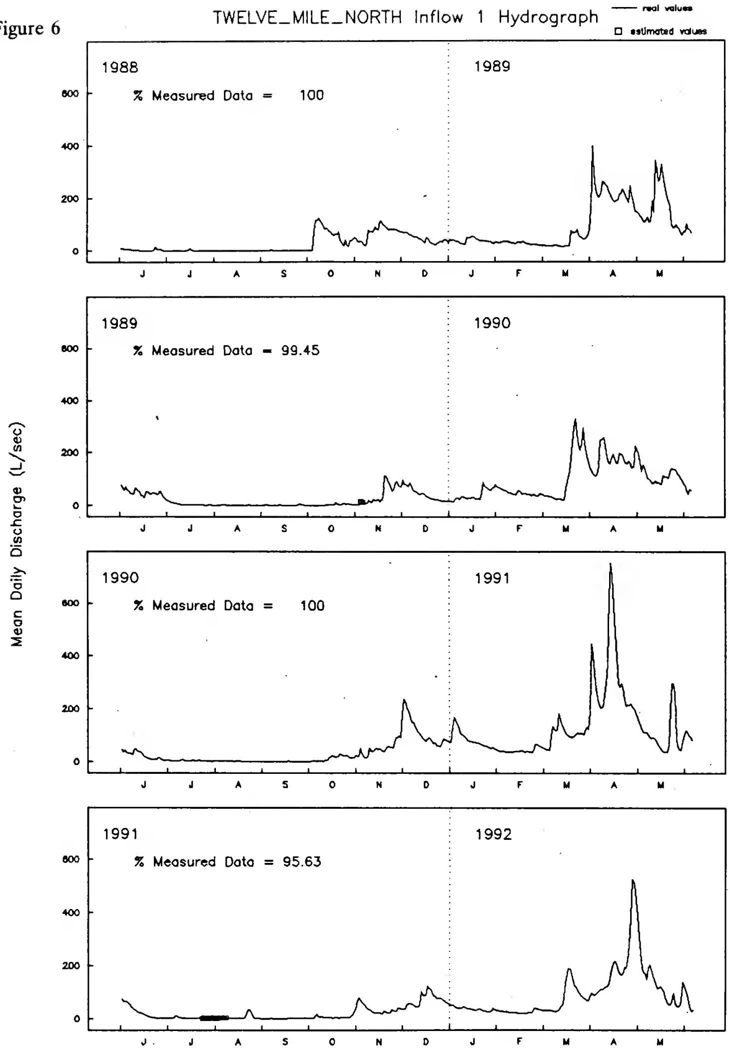
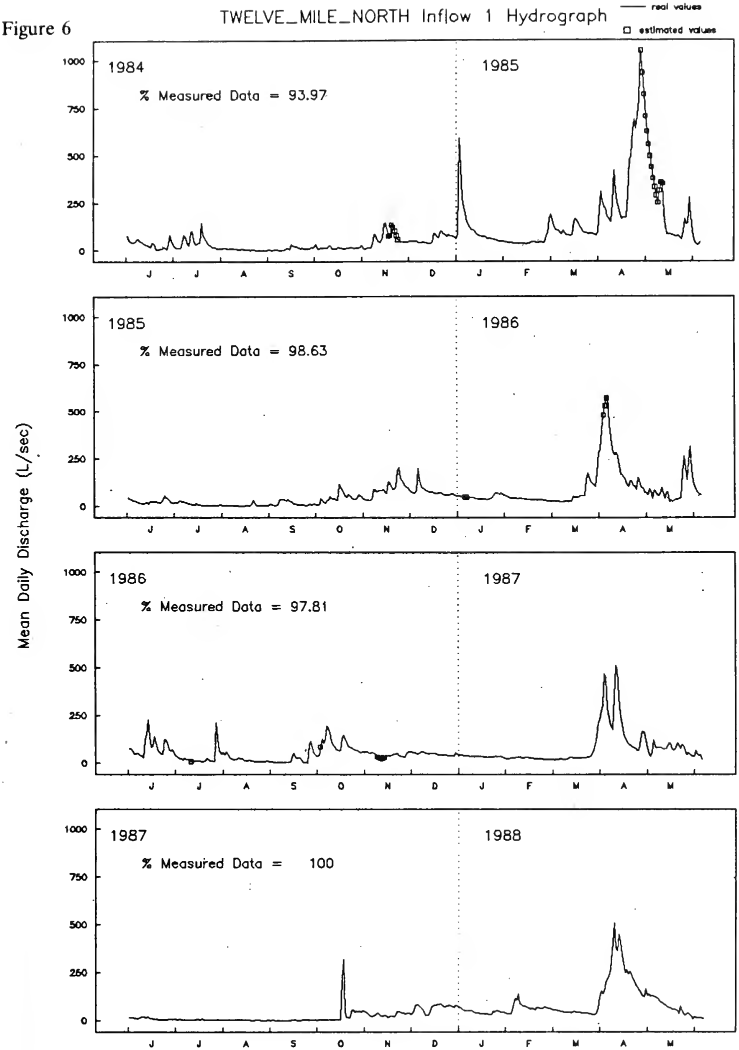

TWELVE_MILE_NORTH Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 100
1989
1990
% Measured Data = 99.45
1990
1991
% Measured Data = 100
1991
1992
% Measured Data = 95.63
0
200
400
600
J J A S O N D J F M A M

Figure 6


TWELVE_MILE_NORTH Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 93.97
1985
1986
% Measured Data = 98.63
1986
1987
% Measured Data = 97.81
1987
1988
% Measured Data = 100
0
250
500
750
1000
J J A S O N D J F M A M

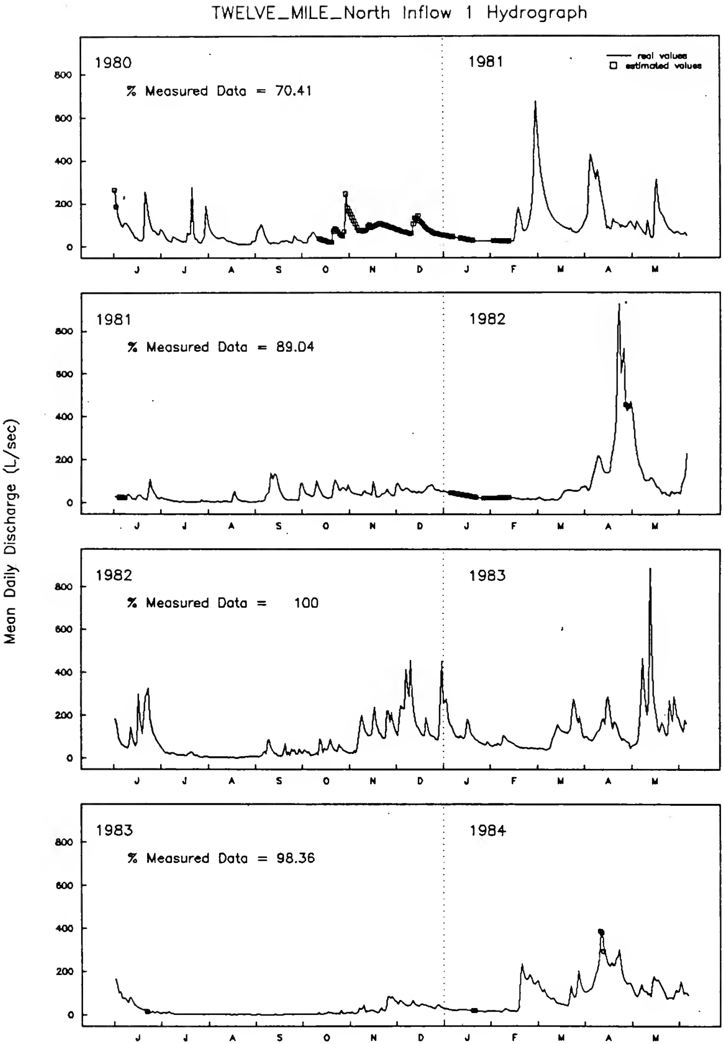

TWELVE_MILE_North Inflow 1 Hydrograph
real values
estimated values
1980
1981
% Measured Data = 70.41
1981
1982
% Measured Data = 89.04
1982
1983
% Measured Data = 100
1983
1984
% Measured Data = 98.36
Mean Daily Discharge (L/sec)
0
200
400
600
800
J J A S O N D J F M A M

Figure 6

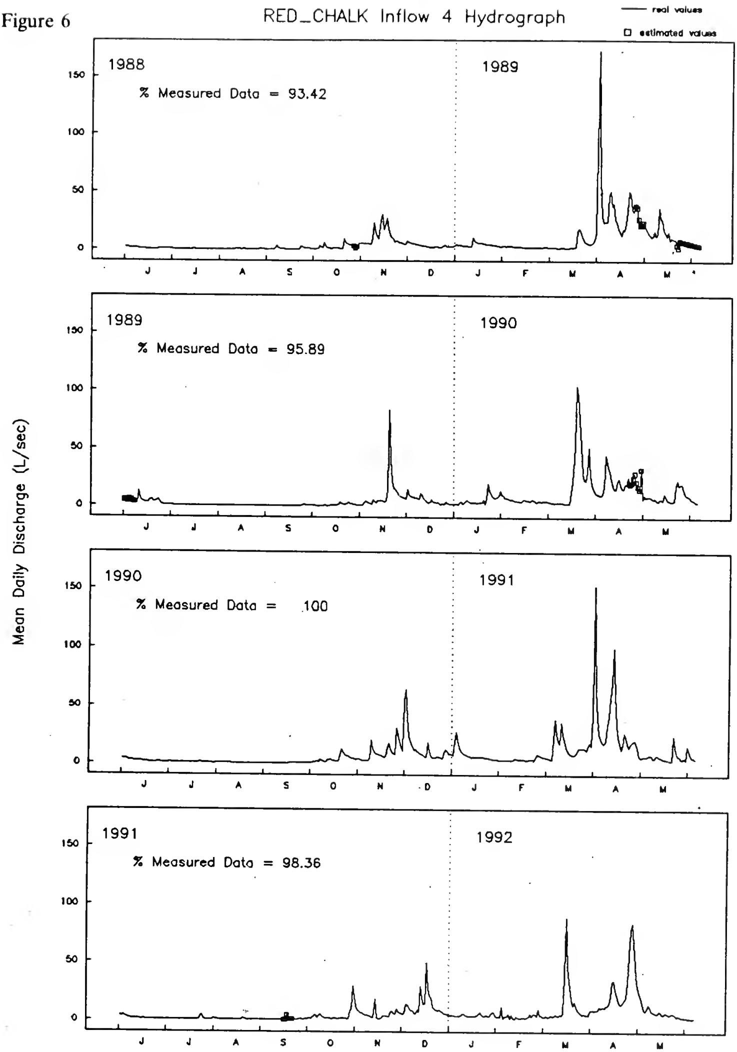

RED_CHALK Inflow 4 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 93.42
1989
1990
% Measured Data = 95.89
1990
1991
% Measured Data = 100
1991
1992
% Measured Data = 98.36
150
100
50
0
J J A S O N D J F M A M

Figure 6

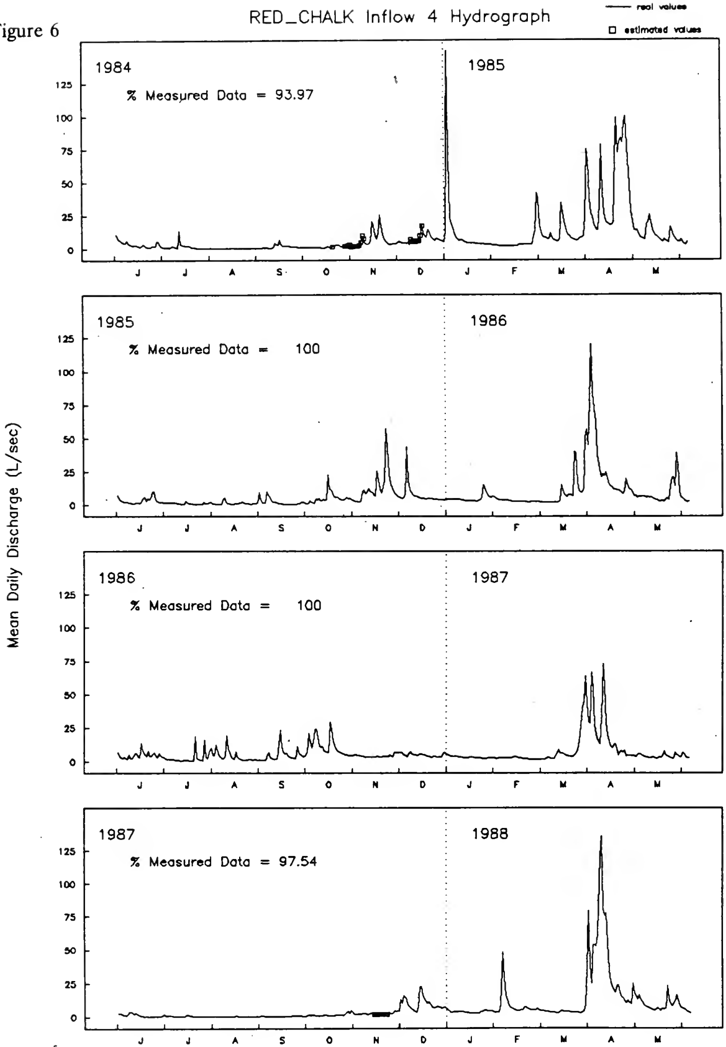
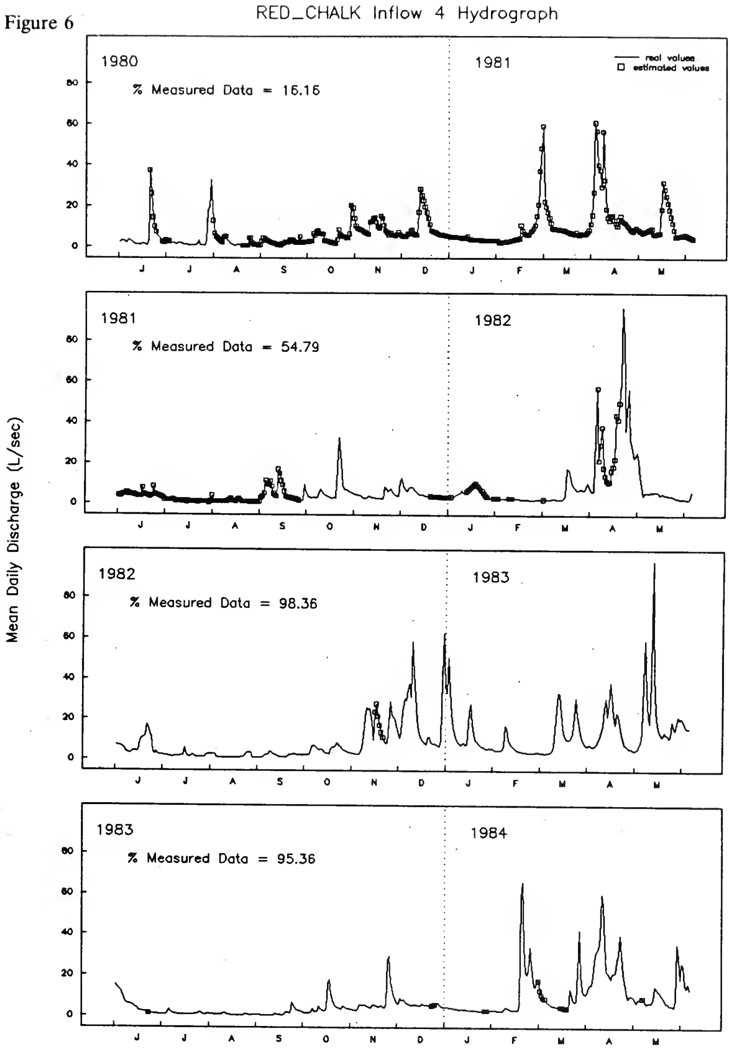

RED_CHALK Inflow 4 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 93.97
1985
1986
% Measured Data = 100
1986
1987
% Measured Data = 100
1987
1988
% Measured Data = 97.54
125
100
75
50
25
0
J J A S O N D J F M A M

Figure 6



RED_CHALK Inflow 4 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 16.16
1981
1982
% Measured Data = 54.79
1982
1983
% Measured Data = 98.36
1983
1984
% Measured Data = 95.36
0
20
40
60
80
J J A S O N D J F M A M

Figure 6

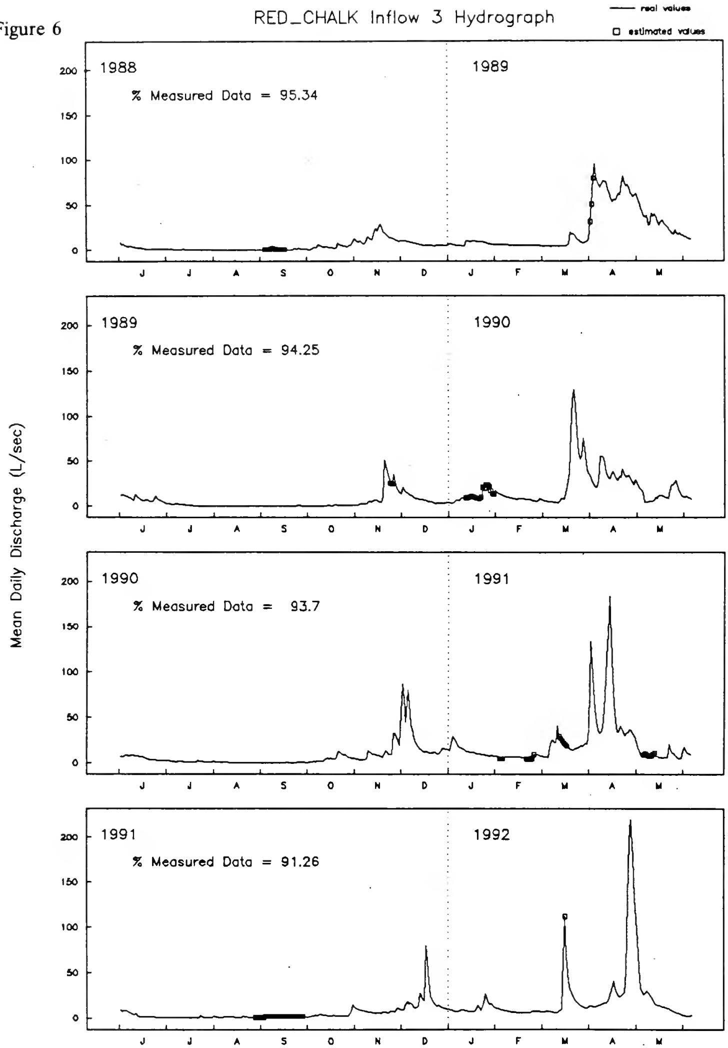

RED_CHALK Inflow 3 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 95.34
1989
1990
% Measured Data = 94.25
1990
1991
% Measured Data = 93.7
1991
1992
% Measured Data = 91.26
0
50
100
150
200
J J A S O N D J F M A M

Figure 6

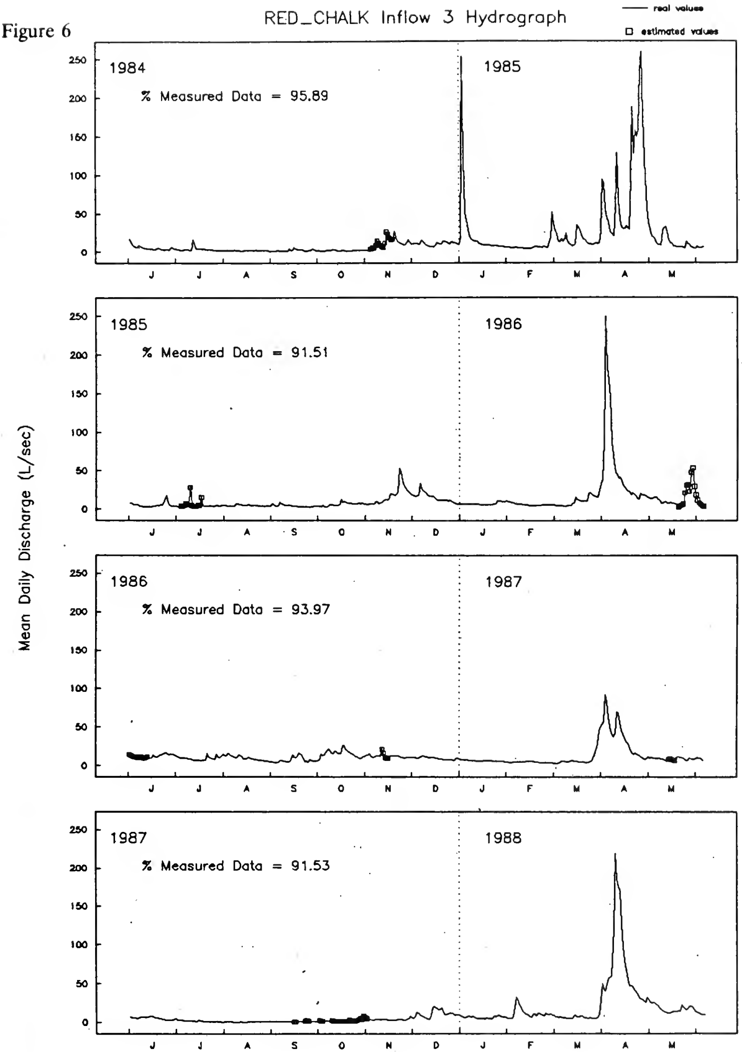

RED_CHALK Inflow 3 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 95.89
1985
1986
% Measured Data = 91.51
1986
1987
% Measured Data = 93.97
1987
1988
% Measured Data = 91.53
250
200
150
100
50
0
J J A S O N D J F M A M

Figure 6

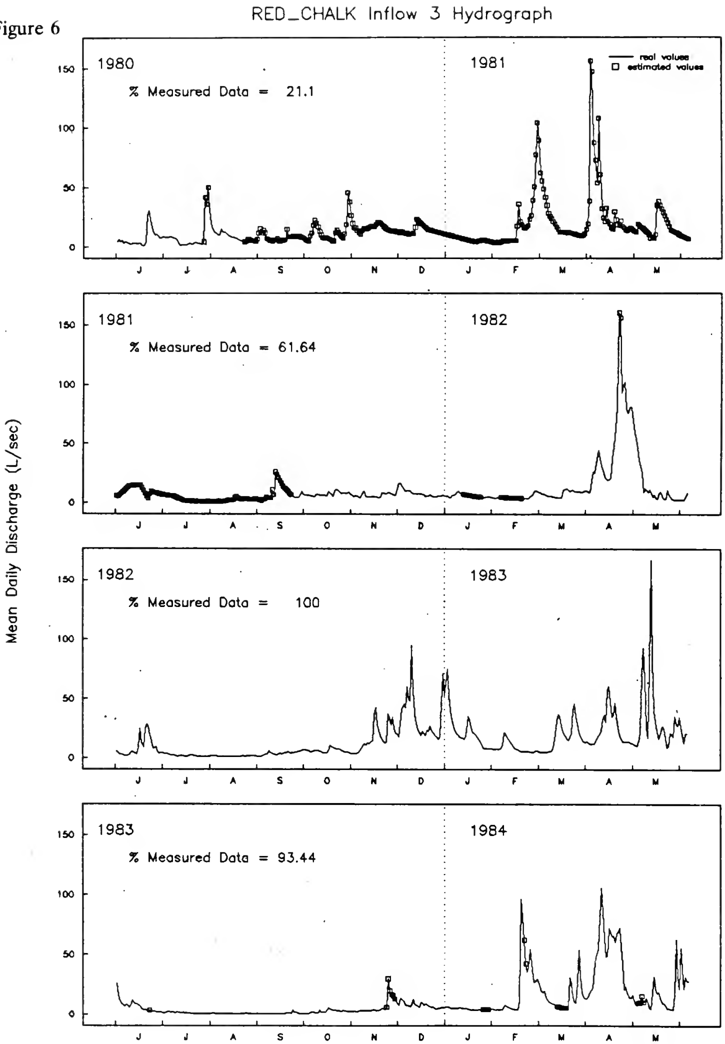

RED_CHALK Inflow 3 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 21.1
1981
1982
% Measured Data = 61.64
1982
1983
% Measured Data = 100
1983
1984
% Measured Data = 93.44
0
50
100
150
J J A S O N D J F M A M

Figure 6

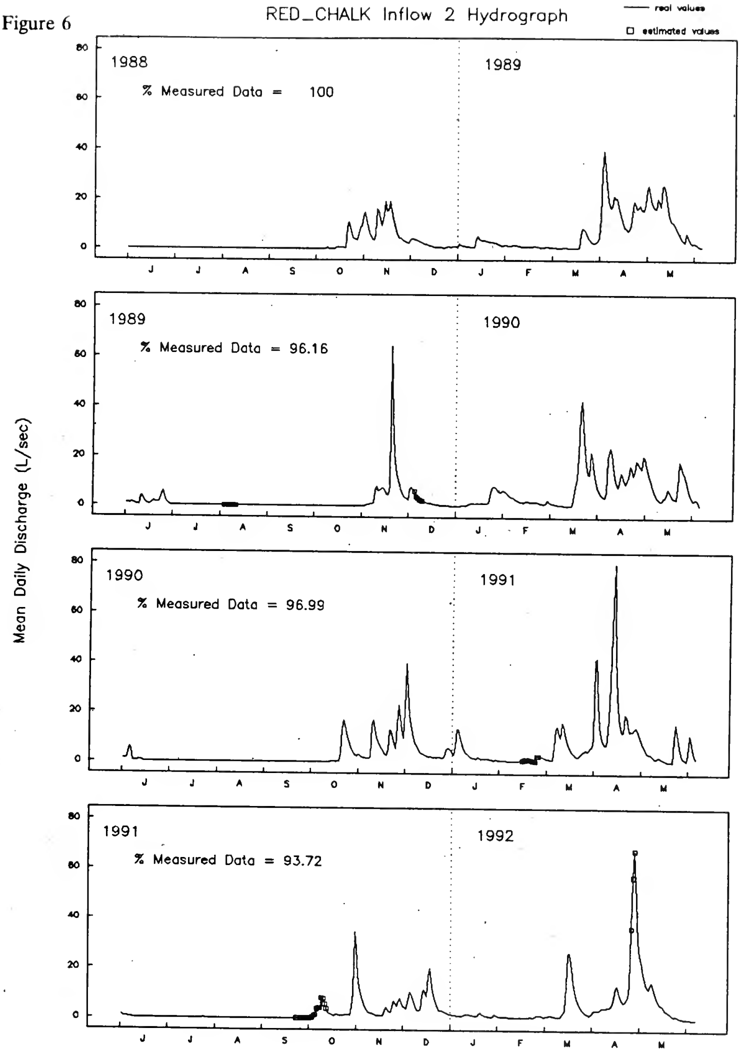
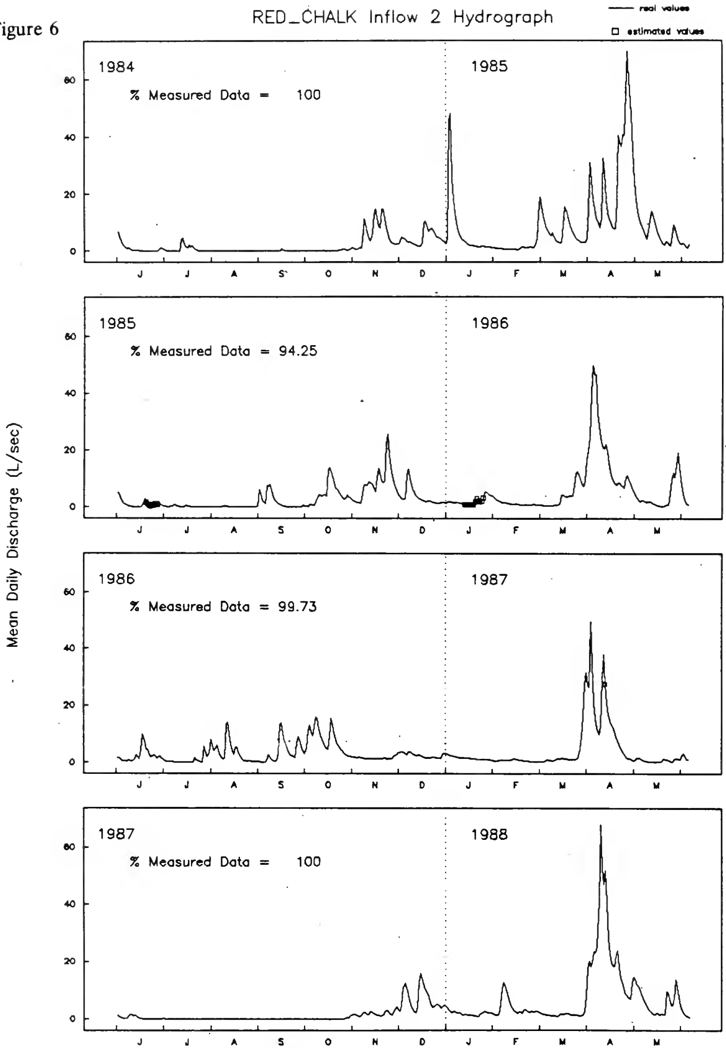

RED_CHALK Inflow 2 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 100
1989
1990
% Measured Data = 96.16
1990
1991
% Measured Data = 96.99
1991
1992
% Measured Data = 93.72
0
20
40
60
80
J J A S O N D J F M A M

Figure 6



RED_CHALK Inflow 2 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 94.25
1986
1987
% Measured Data = 99.73
1987
1988
% Measured Data = 100
0
20
40
60
J J A S O N D J F M A M

Figure 6

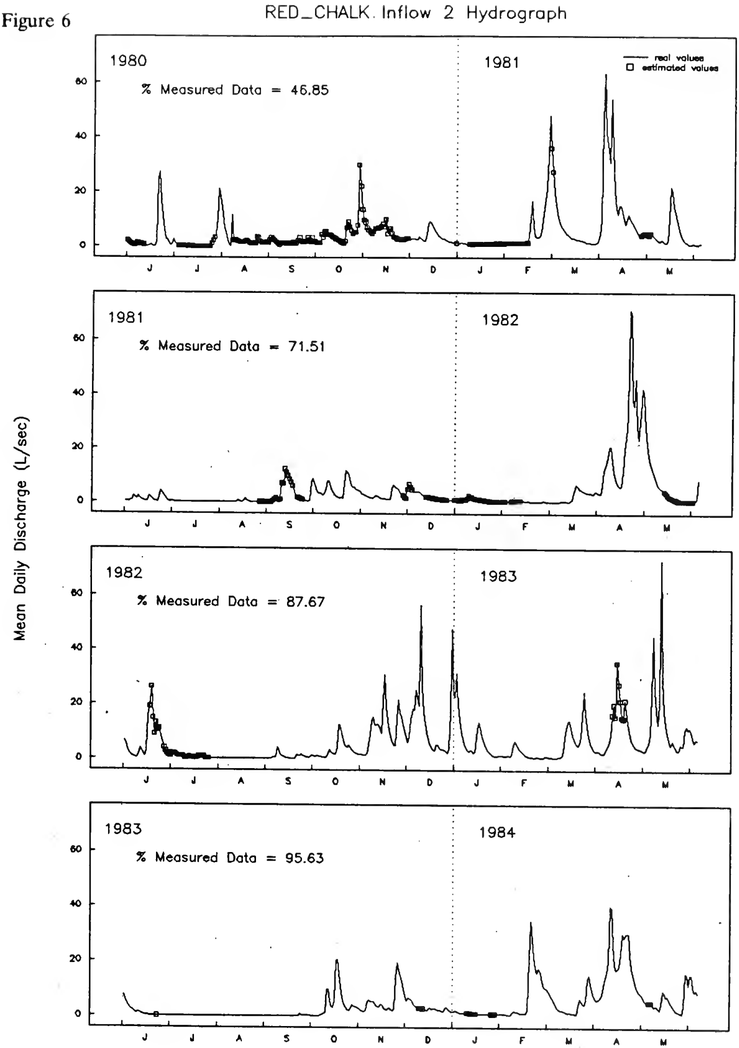
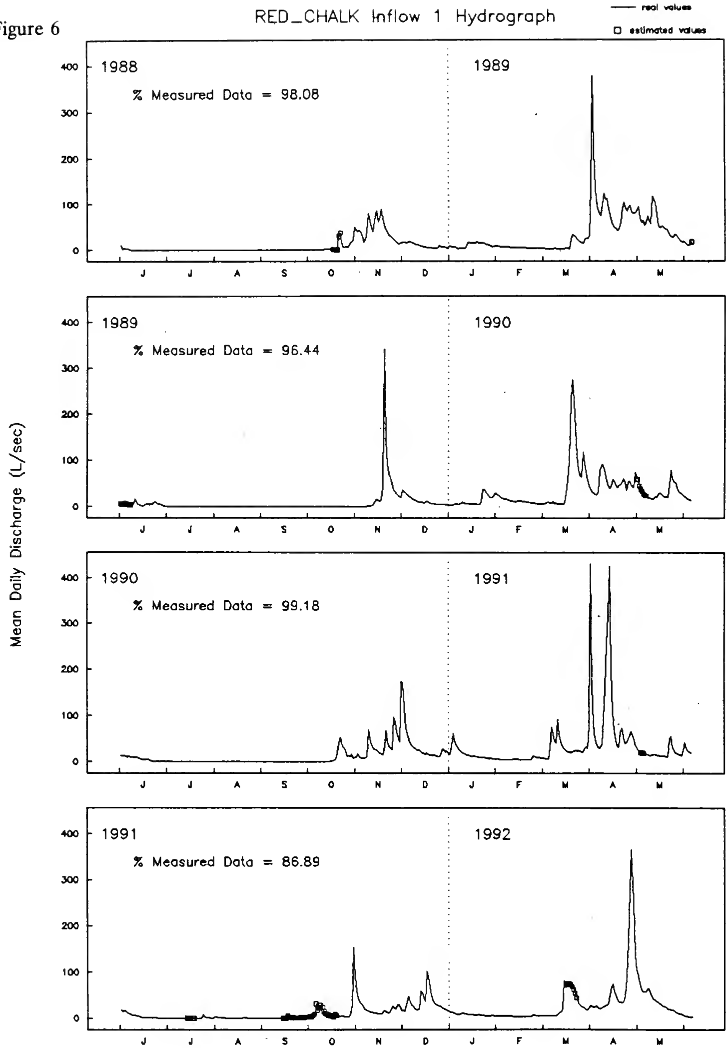

RED_CHALK Inflow 2 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 46.85
1981
1982
% Measured Data = 71.51
1982
1983
% Measured Data = 87.67
1983
1984
% Measured Data = 95.63
0
20
40
60
J J A S O N D J F M A M

Figure 6



RED_CHALK Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 98.08
1989
1990
% Measured Data = 96.44
1990
1991
% Measured Data = 99.18
1991
1992
% Measured Data = 86.89
400
300
200
100
0
J J A S O N D J F M A M

Figure 6

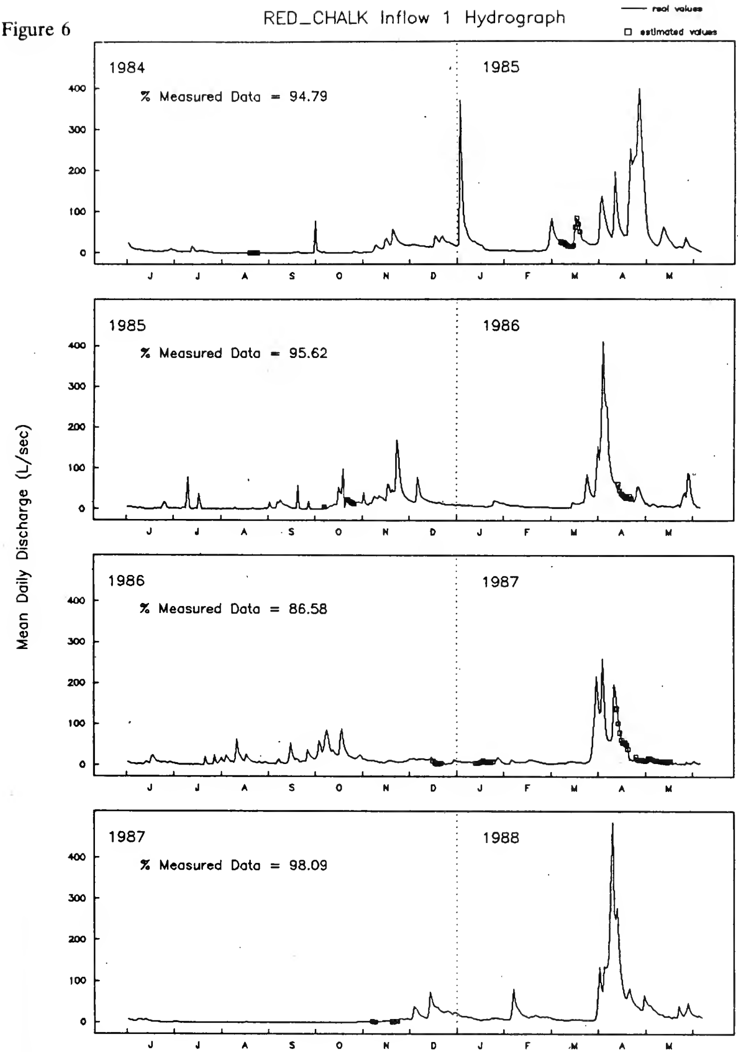

RED_CHALK Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 94.79
1985
1986
% Measured Data = 95.62
1986
1987
% Measured Data = 86.58
1987
1988
% Measured Data = 98.09
0
100
200
300
400
J J A S O N D J F M A M

Figure 6

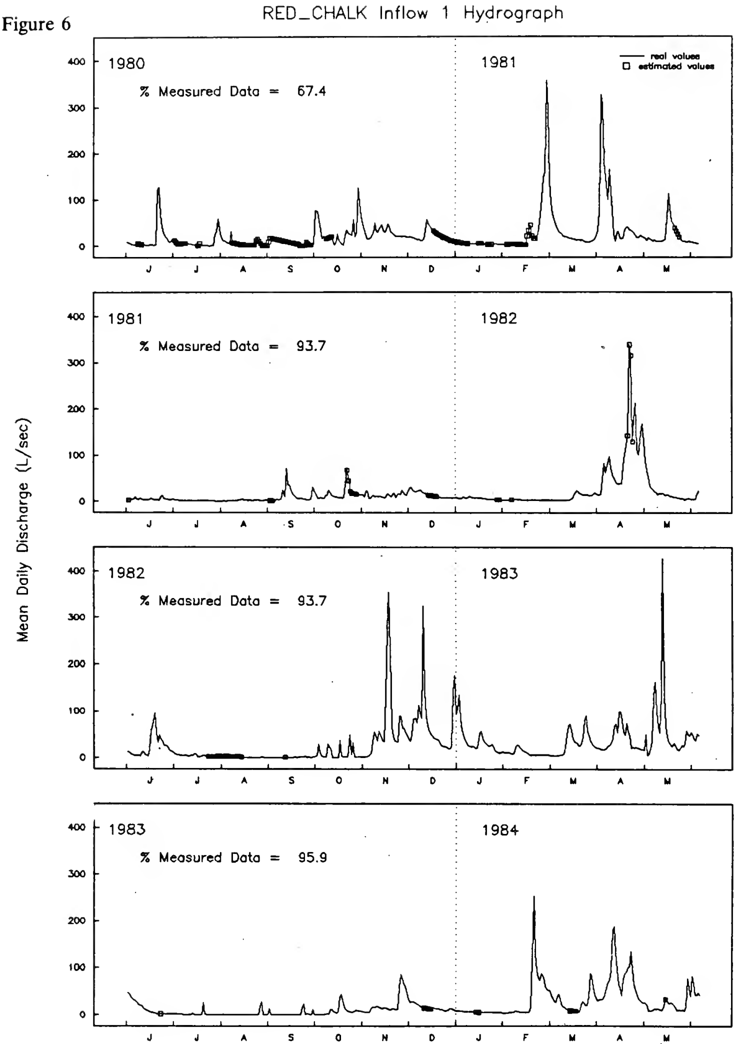
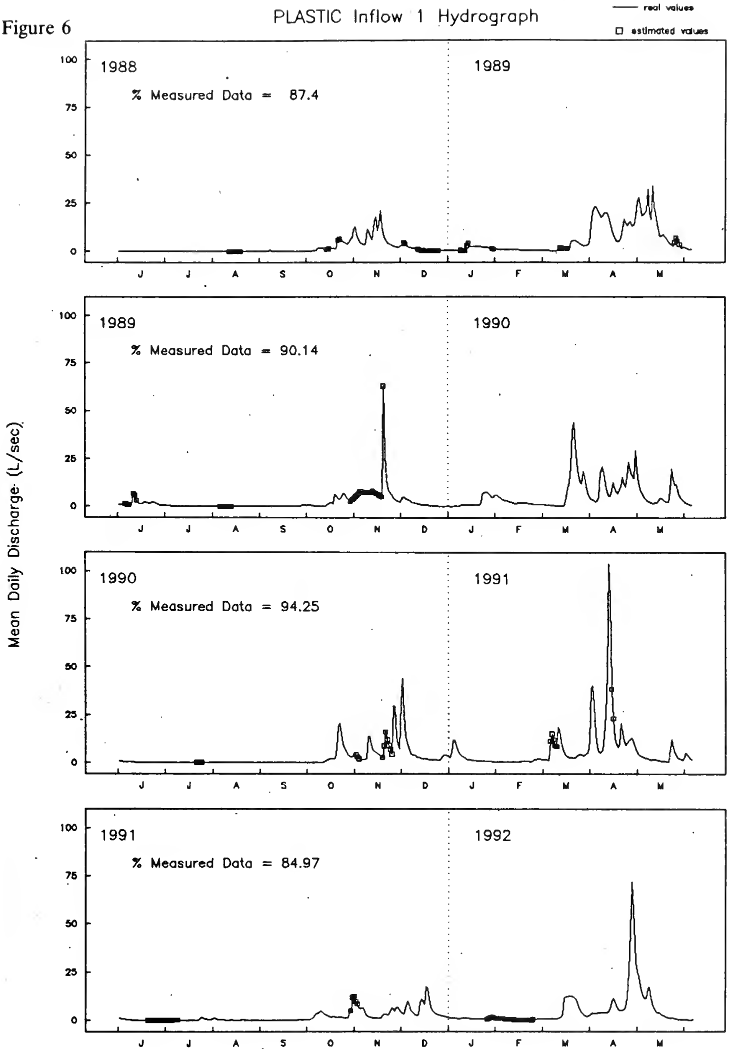
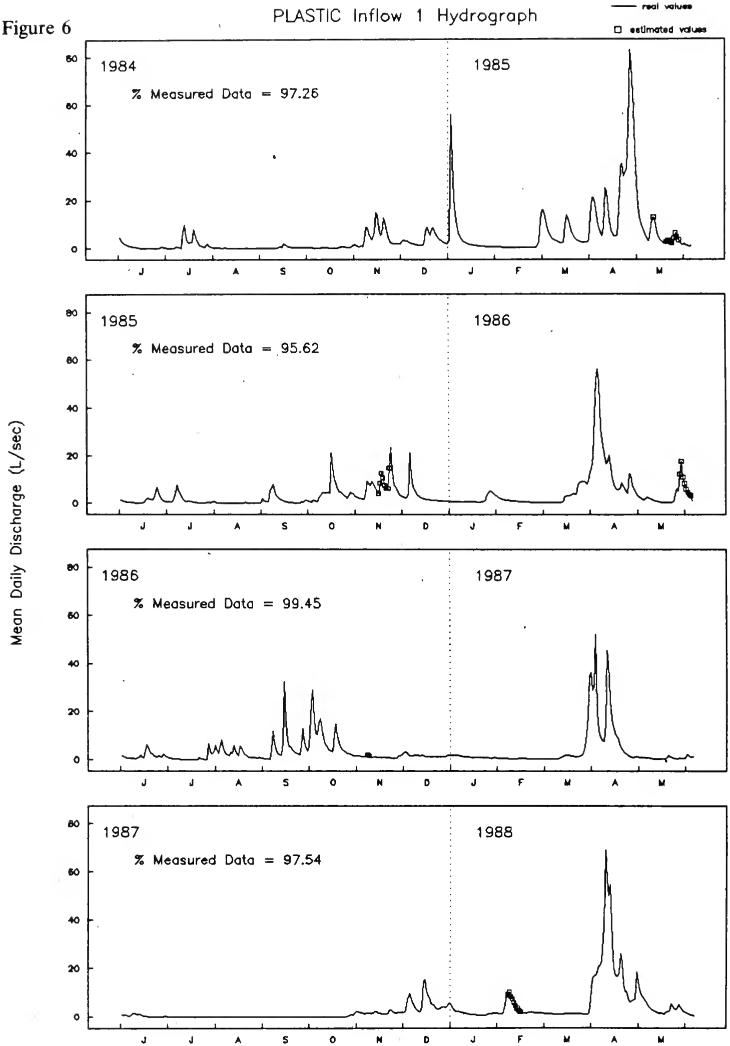

RED_CHALK Inflow 1 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 67.4
1981
1982
% Measured Data = 93.7
1982
1983
% Measured Data = 93.7
1983
1984
% Measured Data = 95.9
400
300
200
100
0
J J A S O N D J F M A M

Figure 6



PLASTIC Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 87.4
1989
1990
% Measured Data = 90.14
1990
1991
% Measured Data = 94.25
1991
1992
% Measured Data = 84.97
0
25
50
75
100
J J A S O N D J F M A M

Figure 6


PLASTIC Inflow 1 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 97.26
1985
1986
% Measured Data = 95.62
1986
1987
% Measured Data = 99.45
1987
1988
% Measured Data = 97.54
0
20
40
60
80
J
J
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S
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F
M
A
M

Figure 6

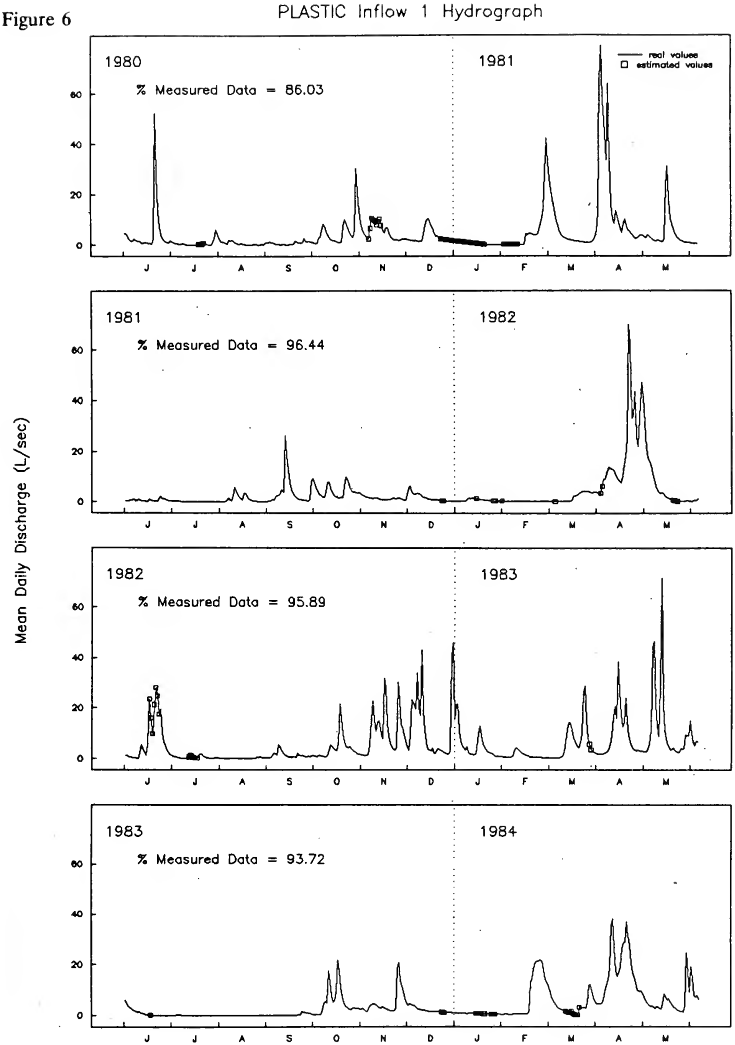

PLASTIC Inflow 1 Hydrograph
real values
estimated values
1980
1981
% Measured Data = 86.03
1981
1982
% Measured Data = 96.44
1982
1983
% Measured Data = 95.89
1983
1984
% Measured Data = 93.72
Mean Daily Discharge (L/sec)
0
20
40
60
J J A S O N D J F M A M

Figure 6

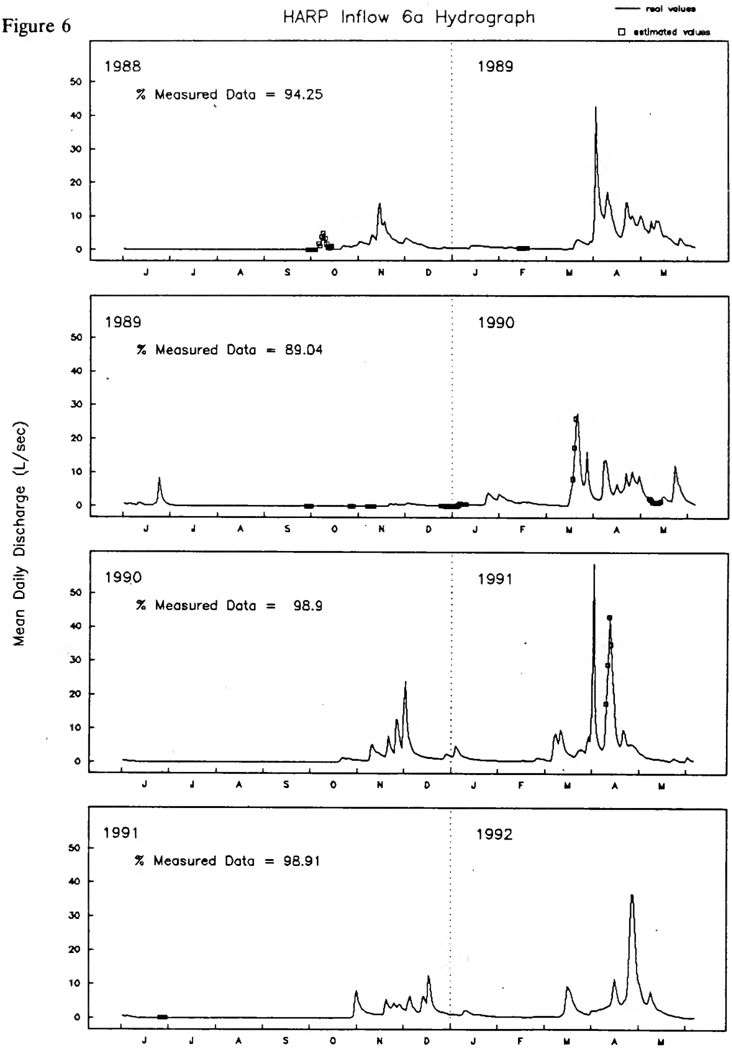

HARP Inflow 6a Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 94.25
1989
1990
% Measured Data = 89.04
1990
1991
% Measured Data = 98.9
1991
1992
% Measured Data = 98.91
J J A S O N D J F M A M

Figure 6

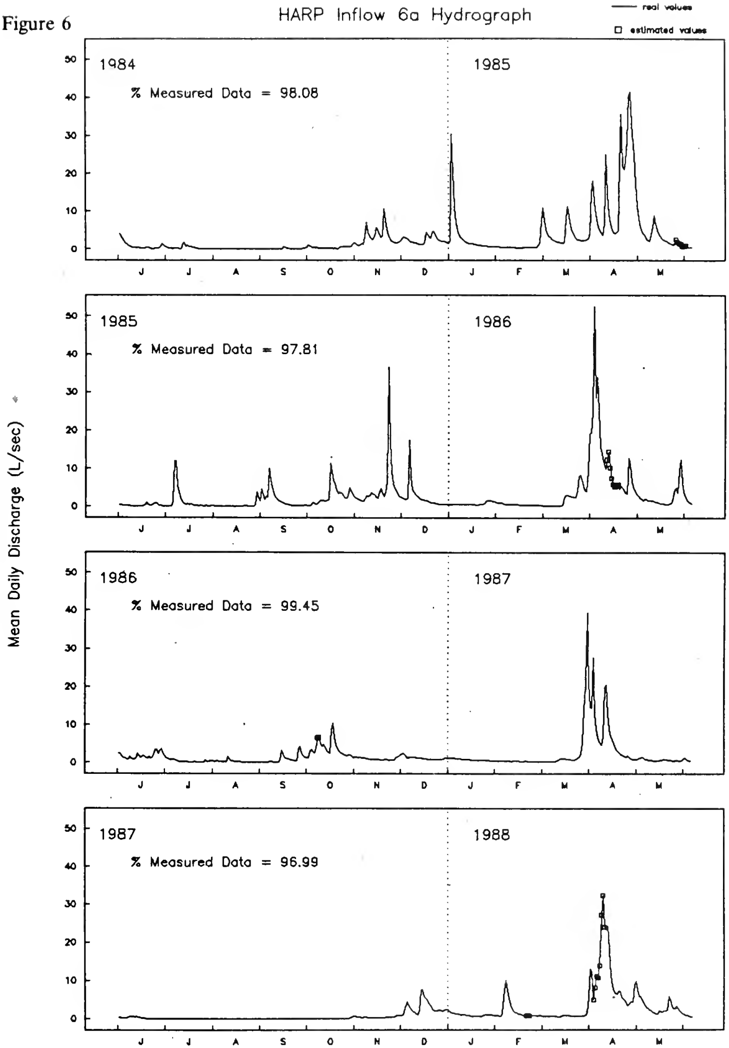

HARP Inflow 6a Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 98.08
1985
1986
% Measured Data = 97.81
1986
1987
% Measured Data = 99.45
1987
1988
% Measured Data = 96.99
0
10
20
30
40
50
J
J
A
S
O
N
D
J
F
M
A
M

Figure 6

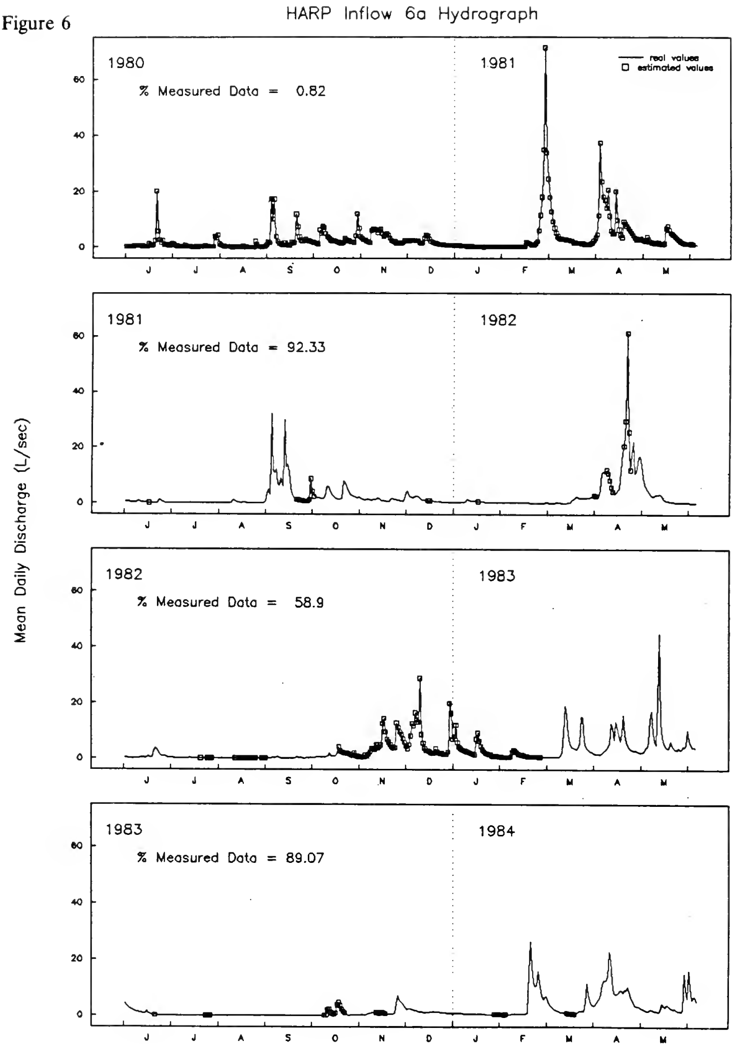

HARP Inflow 6a Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
% Measured Data = 0.82
1981
1981
% Measured Data = 92.33
1982
1982
% Measured Data = 58.9
1983
1983
% Measured Data = 89.07
1984
0
20
40
60
J
J
A
S
O
N
D
J
F
M
A
M

Figure 6

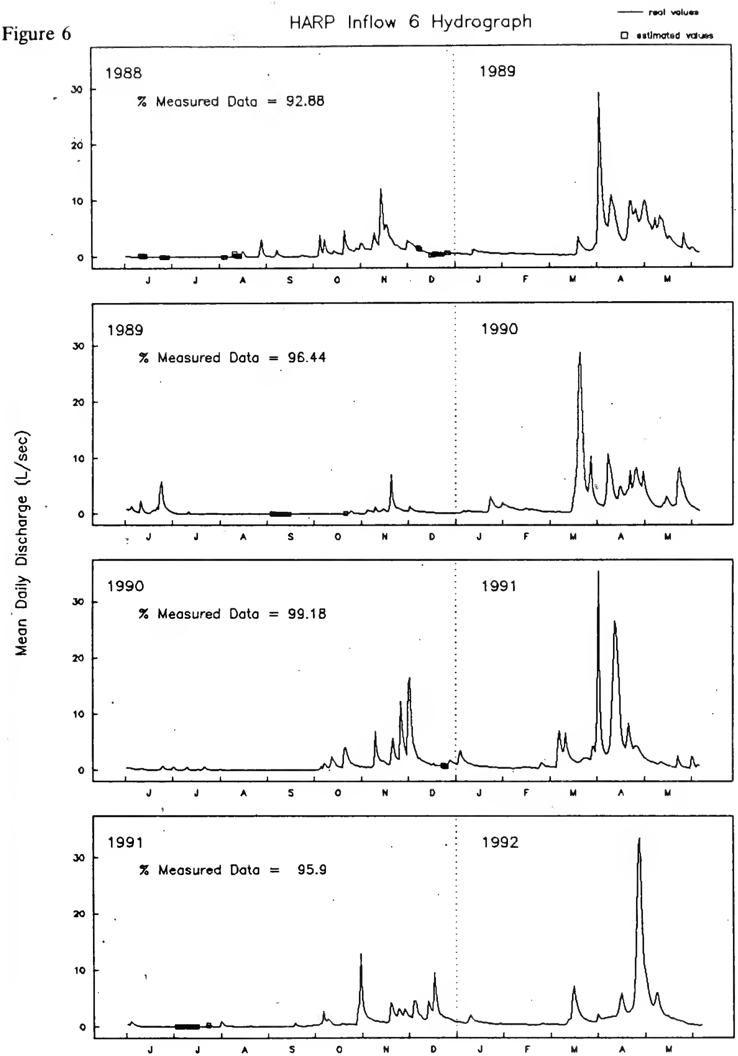

HARP Inflow 6 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 92.88
1989
1990
% Measured Data = 96.44
1990
1991
% Measured Data = 99.18
1991
1992
% Measured Data = 95.9
0
10
20
30
J J A S O N D J F M A M

Figure 6

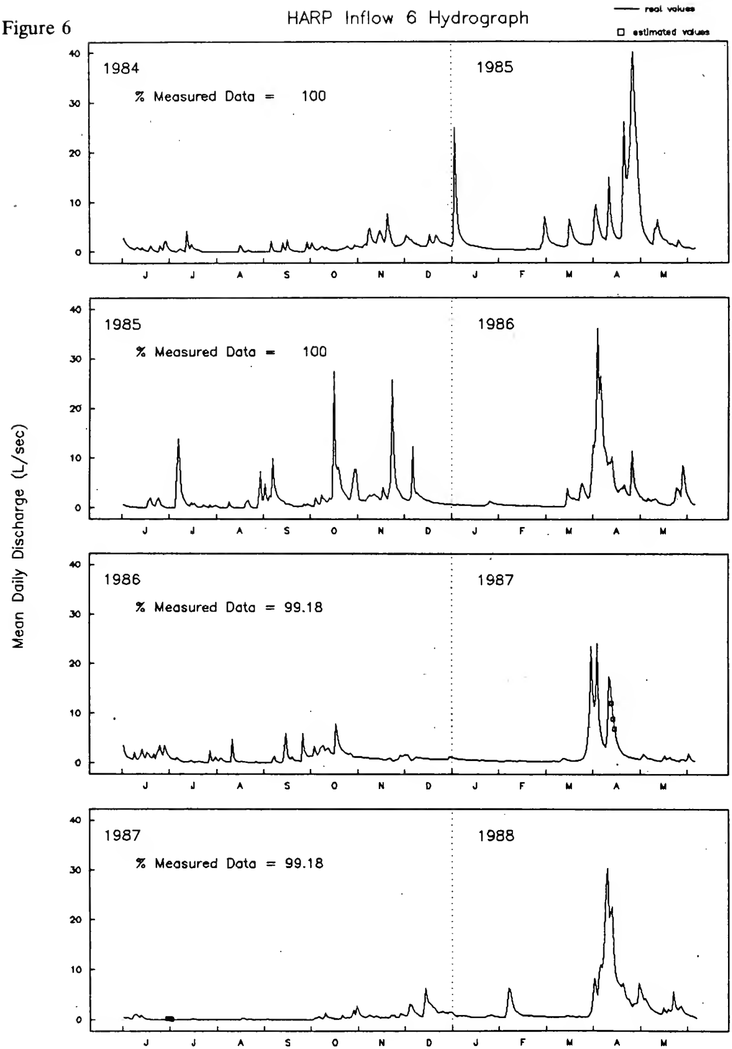

HARP Inflow 6 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1984
1985
% Measured Data = 100
1985
1986
% Measured Data = 100
1986
1987
% Measured Data = 99.18
1987
1988
% Measured Data = 99.18
0
10
20
30
40
J
J
A
S
O
N
D
J
F
M
A
M

Figure 6

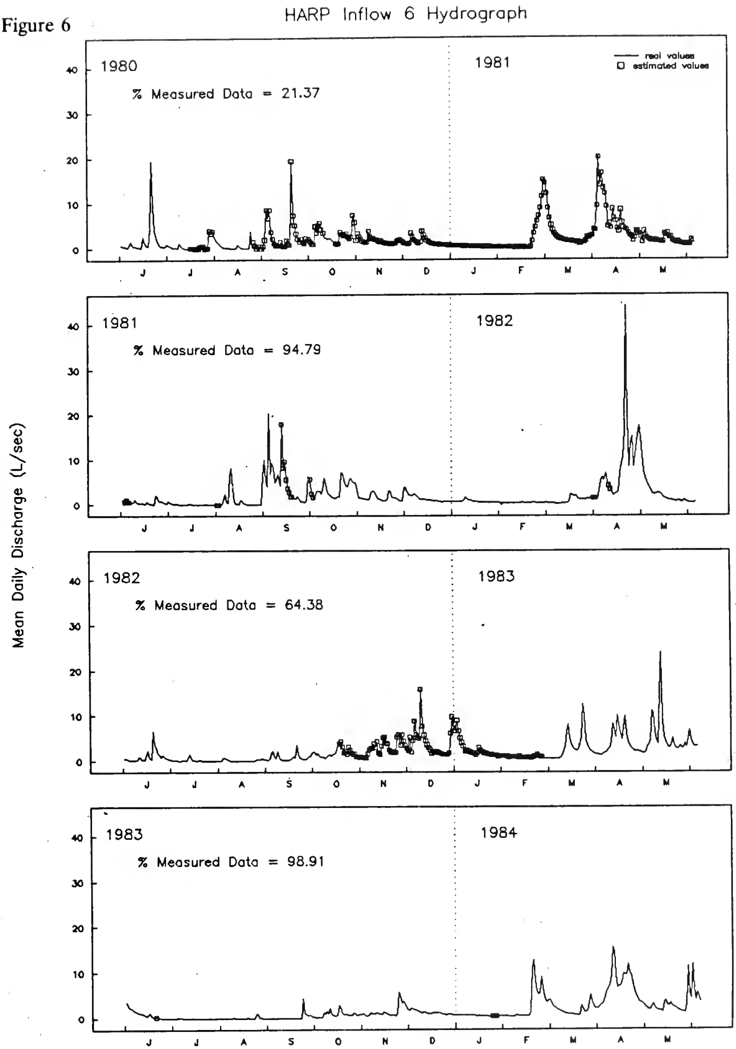
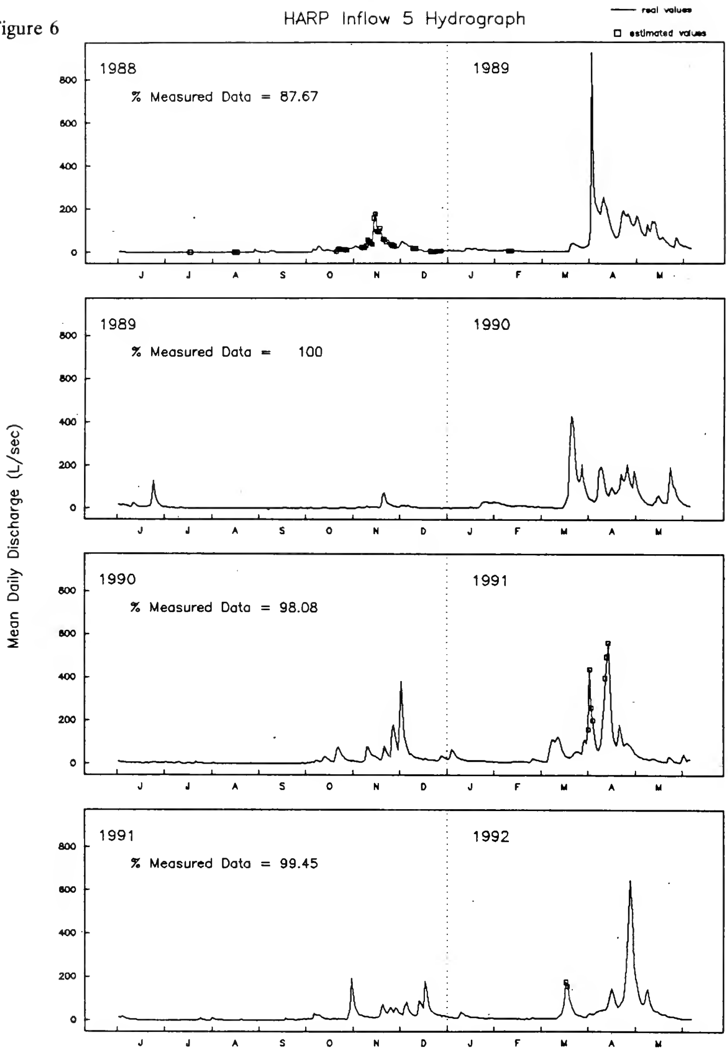

HARP Inflow 6 Hydrograph
Mean Daily Discharge (L/sec)
real values
estimated values
1980
1981
% Measured Data = 21.37
1981
1982
% Measured Data = 94.79
1982
1983
% Measured Data = 64.38
1983
1984
% Measured Data = 98.91
0
10
20
30
40
J J A S O N D J F M A M

Figure 6



HARP Inflow 5 Hydrograph
real values
estimated values
Mean Daily Discharge (L/sec)
1988
1989
% Measured Data = 87.67
1989
1990
% Measured Data = 100
1990
1991
% Measured Data = 98.08
1991
1992
% Measured Data = 99.45
0
200
400
600
800
J
J
A
S
O
N
D
J
F
M
A
M